10881

THE

JOURNAL

85063

OF

GAS LIGHTING,

WATER SUPPLY,

AND

SANITARY IMPROVEMENT.

VOL. XXXII.

July to December, 1878.

LONDON:

WALTER KING

(FOR THE EXECUTORS OF THE LATE WILLIAM B. KING,)

11, BOLT COURT, FLEET STREET, E.C.

THE

JOURNAL OF GAS LIGHTING,

WATER SUPPLY, & SANITARY IMPROVEMENT.

[Registered as a Newspaper.]

Vol. XXXII. No. 790.] LONDON, JULY 2, 1878. [30th Year.] Price 6d.

GAS PURIFICATION
BY
OXIDE OF IRON.

COOKE BROS.,
26, 27, & 28, FENCHURCH ST.,
LONDON, E.C.

SPENT OXIDE PURCHASED IN ANY QUANTITY.

GENUINE TORBAY PAINT
And SPECIAL GASOMETER PAINT.
Several Prize Medals. Established over 20 Years.
These Paints are now used in over 200 Country Gas-Works, and by all the London Gas Companies, on Gas-holders, Scrubbers, Purifiers, &c. Also used by the Admiralty, War Office, Railway Companies, Founders, &c. They prevent and arrest rust, and protect iron from the action of water, sulphurous and gaseous exhalations; do not crack, blister, or flake off; will cover tar effectually.
The covering powers are considerably greater than those of any other Paint.—*See "Engineer," Nov.* 2, 1866.
Supplied, mixed ready for use, or in paste, as desired.
TORBAY PAINT COMPANY.
Proprietors: STEVENS & CO.,
21, GREAT WINCHESTER STREET, LONDON.
Works: BRIXHAM, TORBAY.

THOMAS PROUD,
BROOKFIELD GAS APPARATUS WORKS,
103, ICKNIELD STREET EAST, BIRMINGHAM.
CONTRACTOR FOR
LAYING MAINS
FOR
Gas, Water, & Sanitary Purposes,
AND MANUFACTURER OF
WOOD GRIDS
FOR
SCRUBBERS AND PURIFIERS.

COWEN'S PATENT FIRE-CLAY RETORTS.
JOSEPH COWEN and CO.,
BLAYDON BURN, BLAYDON-ON-TYNE,
Were the only parties to whom a Prize Medal was awarded at the Great Exhibition of 1851, for "Gas-Retorts and other Objects in Fire-Clay," and they were also awarded at the International Exhibition of 1862, the Prize Medal for "Gas-Retorts, Fire-Bricks, &c., for Excellence of Quality."
J. C. and Co. have been for many years the most extensive Manufacturers of Fire-Clay Retorts and Fire-Bricks in the Kingdom. Orders for Fire-Clay Retorts of all shapes and dimensions, and to fit any shaped Mouthpiece, Fire-Bricks, and every other article in Fire-Clay, are promptly executed at their Works as above.
COWEN'S GARESFIELD COALS.
Jos. Cowen & Co. are the only Manufacturers of Fire-Bricks and Clay Retorts at Blaydon Burn.

JOHN RUSSELL AND CO.,
LIMITED,
Established at the commencement of Gas Lighting.
Branch Establishments:
48, GREEK STREET, SOHO SQUARE; } LONDON.
83, COMMERCIAL ST., SPITALFIELDS; }
35, 36, 37, & 39, GRANBY ROW, MANCHESTER.
16, ELLIS COURT, AIRE STREET, LEEDS.
Manufactories: ALMA TUBE WORKS, WALSALL, AND OLD PATENT TUBE WORKS, WEDNESBURY.
J. R. & Co., Ld., are the original manufacturers of Wrought-Iron Gas Tubes and Fittings, and Inventors of the LAP-WELDED TUBES for Locomotive and Marine Boilers.
J. R. & Co., Ld., make all kinds of Tubes and Fittings for Gas, Steam, and Water; Gun-Metal Cocks, Stocks, and Dies; Galvanized Tubes and High-Pressure Tubes, &c.
Lists may be obtained on application to
Head London Office:
145, QUEEN VICTORIA STREET.
Head London Warehouse:
234, UPPER THAMES STREET, LONDON, E.C.

JOHN BENT & SON,
BELL BARN ROAD, BIRMINGHAM,
MANUFACTURERS OF
WET AND DRY GAS-METERS,
LICENSEES AND MANUFACTURERS OF
HUNT'S
PATENT COMPENSATING METERS,
STREET-LAMPS, &c., &c.
Established 1830.

THOMAS PIGGOTT & CO.,
SPRING HILL, BIRMINGHAM,
MANUFACTURERS OF
TELESCOPIC & SINGLE GASHOLDERS
CAST & WROUGHT IRON TANKS FOR DITTO
And Gas Apparatus of every Description.
Marine, Tubular, Cornish, Plain, Furnace, Saddle, and Range Boilers.
Sugar, Saltpetre, and all kinds of Pans.
Roofs, Girders, and Bridges, and General Smith's Work.
London Agent—W. G. DAVIS, 2, Brabant Court, Philpot Lane, E.C.

J. & H. ROBUS,
BUILDERS AND CONTRACTORS
FOR THE
ERECTION AND REBUILDING OF GAS AND WATER WORKS.
ESTIMATES FREE
FOR MAIN-LAYING AND GENERAL REPAIRS
RETORT-SETTING A SPÉCIALITÉ.
ROBUS'S IMPROVED RETORT-SETTINGS guaranteed to carbonize a large amount of coal with a small per cent. of fuel.
N.B.—All kinds of Fire Goods, &c., kept in stock for immediate delivery. Orders promptly attended to.
BELL GREEN, CATFORD, S.E.

THE
NITSHILL COMPANY'S
DUKE OF HAMILTON'S
LESMAHAGOW
CANNEL COAL.
AGENT:
JAMES M'KELVIE,
HAYMARKET,
EDINBURGH.

GEORGE GLOVER & CO.
PATENTEES OF THE
NATIONAL STANDARD GASOMETERS
FOR THE ENGLISH GOVERNMENT
AND FOR THE GOVERNMENT OF THE NETHERLANDS
AND OF THE DUPLICATE COPY
Presented by Her Majesty's Government to the French Government,
AND MANUFACTURERS OF
IMPROVED DRY GAS-METERS
Warranted to Measure correctly & not to vary.
RANELAGH WORKS, RANELAGH ROAD, PIMLICO, LONDON, S.W.
236, GEORGE STREET, GLASGOW, & 30, LANCASTER AVENUE, MANCHESTER.
FOREIGN AGENTS.
DAHL BROTHERS, COPENHAGEN. | W. HOVEN & SON, ROTTERDAM.
A. FAAS & CO., FRANKFORT O/M. | COPLAND & McLAREN, MONTREAL
A. DEMPSTER, 57 ELIZABETH STREET, MELBOURNE.

JOSEPH AIRD,

WELLINGTON TUBE-WORKS, TIPTON, STAFFORDSHIRE,

MANUFACTURER OF

EVERY DESCRIPTION OF TUBING, GAS, STEAM, HYDRAULIC TUBES AND FITTINGS,
EITHER BLACK, GALVANIZED, OR ENAMELLED HOT WATER TUBES AND FITTINGS,
CORE BARS, COILS, COCKS (IRON OR BRASS),
CHANDELIERS, &c., GAS-FITTERS' TOOLS, GAS TONGS, STOCKS, TAPS, DIES, &c., &c.,
HANDRAIL TUBINGS, IRON AND BRASS, PLAIN OR TWISTED,
TELEGRAPH TUBES OR POLES, &c., &c.

LAMBERT BROTHERS, WALSALL.

ALPHA TUBE & FITTING WORKS

Manufacturers of W. J. WARNER'S PATENT MARKET GAS STAND-PIPE.

Now ready, GAS CHANDELIER BOOK (Reduced Prices), 7s. 6d.

LIVESEY'S PATENT WASHER.

This apparatus effects the most intimate contact between the liquor with which it is supplied and the gas passing through it, resulting in the complete removal of all particles of tar, increasing the ammonia strength of the scrubber and condenser liquor, and removing a large proportion of other impurities—notably, carbonic acid. The Washer is intended to work in conjunction with a scrubber. It occupies little space, and is inexpensive. It has been in successful constant use for nearly three years, does not become clogged with tar or corroded by the action of the liquor or gases, it gives three inches of pressure, and only needs a supply of liquor to keep it in regular action without any further attention.

For Particulars and Prices apply to

Messrs. DEMPSTER AND SONS, ELLAND, HALIFAX, for the North;
Messrs. BAILEY, PEGG, AND CO., Bankside, LONDON, S.E., for the South;
Messrs. WILLEY AND CO., Commercial Road, EXETER, for West of England and South Wales;
Or to the PATENTEE, 589, OLD KENT ROAD, LONDON, S.E.

THOMAS ALLAN & SONS,

IRONFOUNDERS.

WORKS:

SPRINGBANK FOUNDRY & NORTH WOODSIDE FOUNDRY,
GLASGOW;

BONLEA FOUNDRY, STOCKTON-ON-TEES,

Manufacturers of

CAST-IRON GAS AND WATER PIPES.

SIZES: ¾ to 12 inches at GLASGOW.
„ 1½ to 10 „ STOCKTON.

A LARGE STOCK KEPT, AND PRICES MODERATE.

Freight to London, in the Stream, 10s. per ton from Stockton; 15s. from Glasgow.

AGENTS FOR LONDON AND THE SOUTH OF ENGLAND:
THE THAMES BANK IRON COMPANY, UPPER GROUND STREET, LONDON, S.E.

WELLS, BIRCH, RYDE, and CO., Limited,

HOYLAND SILKSTONE COLLIERIES,

Near BARNSLEY.

This Company is now in a position to raise **2000 tons per day of REAL OLD SILKSTONE GAS COAL.**

"The quality of this Coal for Gas purposes, if equalled, is not excelled by any on record, and the Coke competes successfully with best Durham."—See *Mining Journal*, Aug. 11, 1877.

Prices quoted to any Railway Station, or F.O.B. Hull, Grimsby, Goole, Keadby, Liverpool, and Fleetwood.

Full particulars will be sent on application to above address.

JOHN ABBOT & CO., LIMITED,

MANUFACTURERS OF

IMPROVED

HYDRAULIC CRANES & HOISTS,

Effecting an IMMENSE SAVING in the cost of discharging Coals from Vessels, Barges, &c.

HYDRAULIC RAMS FOR LIFTING AND LOWERING PURIFIER COVERS.

GAS PLANT GENERALLY, PIPES, ROOFING, TANKS, &c.,

PARK WORKS, GATESHEAD.

LONDON OFFICES: 2, SUFFOLK LANE, CANNON STREET, E.C.

GLASGOW OFFICES: 54, ST. ENOCH'S SQUARE.

WILLEY & COMPANY,

GAS ENGINEERS,

WORKS: COMMERCIAL ROAD, EXETER,

INVITE THE ATTENTION OF GAS COMPANIES AND OTHERS FOR THE SUPPLY OF

EVERY DESCRIPTION OF GAS APPARATUS.

ENGINEERING DEPARTMENT.

NEW GAS-WORKS erected complete. Plans and Estimates furnished. MAINS, METERS, SERVICES, LAMPS, &c., adapted for Towns of any size. Gas Companies advised on Improvements, Extensions, and Alterations of Works.

GASHOLDERS AND TANKS.

RETORTS and RETORT-HOUSE FITTINGS, CONDENSERS, SCRUBBERS, ENGINES and EXHAUSTERS, PURIFIERS, STATION-METERS, GOVERNORS, VALVES, &c.

METER DEPARTMENT.

They beg special attention to the excellence and superiority of their WET and DRY METERS, several thousand being now in use by many of the largest Gas Companies in the West of England and South Wales. Warranted to measure correctly, and not to vary. Their acknowledged superiority has brought them into general use more rapidly than any Meters hitherto manufactured. A guarantee of Five years tendered with each Meter.

GAS-FITTING DEPARTMENT.

An extensive variety of Choice Designs in CHANDELIERS, PENDANTS, BRACKETS, STAR and SUN LIGHTS, MEDIÆVAL FITTINGS for CHURCHES, &c.

PATTERN-BOOKS and PRICE LISTS furnished.

☞ PLEASE NOTE THE ADDRESS—

GAS ENGINEERING WORKS, COMMERCIAL ROAD, EXETER.

WEST'S GAS IMPROVEMENT COMPANY,

LIMITED,

ARE NOW PREPARED TO SUPPLY AND ERECT THEIR PATENTED MACHINERY FOR

CHARGING AND DRAWING GAS-RETORTS,

And to enter into arrangements with GAS COMPANIES for its use upon moderate terms of Royalty.

The Patented Machinery has secured the approbation of all Engineers who have visited the MAIDSTONE GAS-WORKS, *where it is in full operation, and may be inspected at any time on application to the Manager.*

The advantages attending its use are—

INCREASED VOLUME OF GAS PER TON.—INCREASED YIELD PER RETORT.—INCREASED BULK OF COKE FOR SALE.—REDUCTION IN LABOUR AND LESS DEPENDENCE ON SKILLED STOKERS.

A Pamphlet containing a description of the Machinery, and Copies of Reports on the working of the same, &c., will be forwarded on application to the MANAGING DIRECTOR, Maidstone. Communications may also be addressed to the Consulting Engineer, R. P. SPICE, Esq., M. Inst. C.E., 21, Parliament Street, London, S.W., or to the Engineer and Analyst, F. W. HARTLEY, Esq., A. Inst. C.E., 55, Millbank Street, London, S.W.

GAS PURIFICATION

BY

OXIDE OF IRON.

GAS PURIFICATION & CHEMICAL Co., LIMITED,

PALMERSTON BUILDINGS, OLD BROAD STREET, LONDON, E.C.

JOHN WM. O'NEILL, Managing Director.

ROBT. DEMPSTER & SONS,

GAS ENGINEERS, IRONFOUNDERS, AND CONTRACTORS,

ROSE MOUNT IRON-WORKS, ELLAND, YORKSHIRE.

MANUFACTURERS OF EVERY DESCRIPTION OF

GAS APPARATUS;

CONTRACTORS FOR THE

ERECTION OF PUBLIC AND PRIVATE GAS-WORKS.

Plans and Specifications Prepared, and Illustrated Catalogues forwarded on application.

THE

IMPERIAL METER COMPANY,

LIMITED.

KING'S ROAD, LONDON, N.W.,

OFFICE: 115, VICTORIA STREET, WESTMINSTER, S.W.,

MANUFACTURERS OF

"WET" & "DRY" GAS-METERS IN IRON & TIN-PLATE CASES,

STATION-METERS AND GOVERNORS, STREET-LAMP METERS, BOXES, AND REGULATORS FOR THE AVERAGE METER SYSTEM.

Attention is called to their Dry Meters in Wood Cases, as used by the principal London Gas Companies. These Meters are especially suitable for seaport towns and for export.

The Company repair or convert every description of Wet Gas-Meters to De Castro and Burton's Patent.

METALLIC OXIDE PAINT,

Specially adapted for painting Iron and Woodwork in and about **Gas-Works**, as it is not affected by the ammoniacal gases always present, but will keep its **Colour and Hardness** under the most trying circumstances; it forms a very hard surface, and effectually prevents iron from corroding; it will not crack or blister, and resists alike the heat of summer and the cold of winter.

Used extensively throughout Lancashire, Yorkshire, and neighbourhood. Among our customers are the following:—The Manchester and Salford Corporations the Gas Companies at Rochdale, Sowerby Bridge, Halifax, Stalybridge, Blackburn, Leigh, St. Helen's, &c.

Supplied mixed ready for use, or in stiff paste.

J. E. WILLIAMS & CO., VICTORIA PAINT WORKS, COLLYHURST, MANCHESTER.

EDWARD COCKEY & SONS,

GAS ENGINEERS, FROME SELWOOD,

MANUFACTURERS OF ALL DESCRIPTIONS OF

APPARATUS CONNECTED WITH GAS-WORKS.

THE ORIGINAL PATENTEES AND MANUFACTURERS OF THE

DRY-FACED VALVES

FOR PURIFIERS, GASHOLDERS, BYE-PASS, AND OTHER ARRANGEMENTS REQUIRING VALVES IN GAS-WORKS.

The Faced Valves, as made by the Patentees, continue to give great satisfaction, and they are being used extensively by many of the best gas engineers of the day.

They are more easily repaired than any other kind of Valve in use, and can be re-ground in a few hours without removal, and made perfectly gas-tight.

References can be given to many Engineers of high standing, who will testify as to the favour in which they are held.

MANUFACTURERS ALSO OF SUPERIOR WOOD GRIDS FOR PURIFIERS, SCRUBBERS, &c.

GEORGE ORME & CO.,

ATLAS METER-WORKS, OLDHAM,

MANUFACTURERS OF

WET AND DRY GAS-METERS,

STATION-METERS, GOVERNORS,

PRESSURE AND EXHAUST REGISTERS,

LAMP-METERS IN CAST-IRON BOXES,

And every Description of Gas Apparatus.

J. T. B. PORTER & CO.,

GAS ENGINEERS & MANUFACTURERS,

IRONFOUNDERS AND CONTRACTORS,

GOWTS BRIDGE WORKS,

LINCOLN.

LONDON OFFICES: 1, WESTMINSTER CHAMBERS, S.W.

ESTIMATES FOR GAS-WORKS OF ANY SIZE.

REFERENCES TO 500 WORKS ALREADY ERECTED.

N.B.—All Communications to be addressed to the FIRM ONLY.

J. & J. BRADDOCK,

GAS ENGINEERS,

GLOBE METER-WORKS, OLDHAM,

MANUFACTURERS OF

WET & DRY CONSUMERS GAS-METERS,

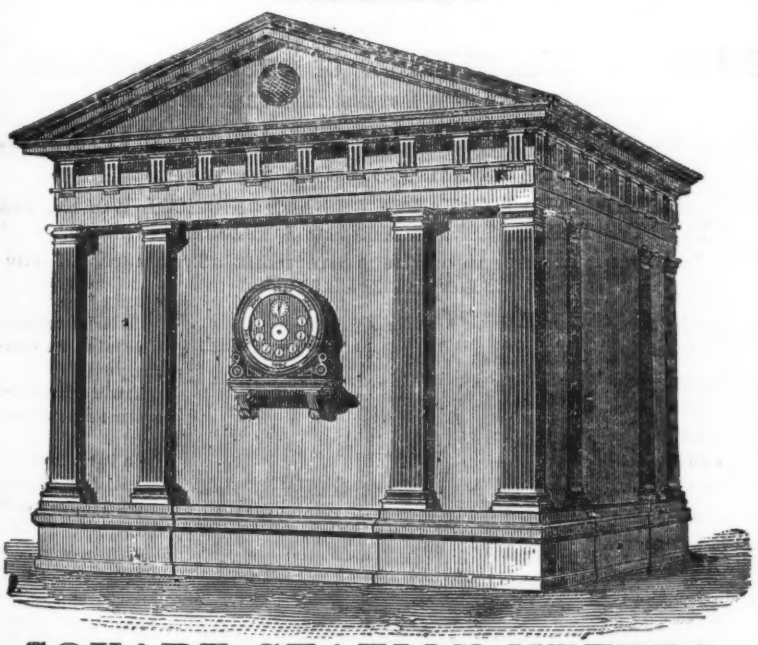
OF THE HIGHEST EXCELLENCE ONLY;

ALSO LICENSEES AND MANUFACTURERS OF

WARNER & COWAN'S PATENT SELF-REGULATING GAS-METERS;

ROUND STATION-METERS,

ON CAST-IRON STANDS.



SQUARE STATION-METERS,

WITH PLANED JOINTS.

GOVERNORS, GAUGES, INDICATORS, MAIN COCKS, &c.

GAS COOKING APPARATUS.

Home and Foreign Orders promptly attended to.

All Sizes of CONSUMERS METERS, STATION-METERS, and GOVERNORS generally in Stock.

Orders almost invariably despatched on the day of receipt.

TERMS, &c. ON APPLICATION.

M. BREMOND'S NAPHTHALINE PROCESS.

All negotiations respecting M. Brémond's patented process for preventing Deposits of

NAPHTHALINE

in Gas Main and Service Pipes should be addressed to Mr. W. H. BENNETT, 22, Great George Street, WESTMINSTER, S.W., or to M. BREMOND, Gas Engineer, Compania Madrilena de Alumbrado y Calefaccion por Gas, MADRID, who may be consulted upon all matters connected with the Gas Industry.

C. & W. WALKER'S

WOOD PURIFIER SIEVES,

Which have now been used for fifteen years, and their advantages and durability fully established. They are made entirely by steam machinery in very large quantities at the most moderate cost.

MIDLAND IRON-WORKS,

DONNINGTON, NEAR NEWPORT, SHROPSHIRE.

8, FINSBURY CIRCUS, LONDON.

ESTABLISHED IN 1860.

BENJAMIN CARPENTER,

THE ORIGINAL MANUFACTURER OF THE IMPROVED

WOOD SIEVES

FOR

GAS PURIFIERS & SCRUBBERS.

PROVIDENCE WORKS,

22, HERMES STREET, PENTONVILLE ROAD

LONDON, N.

DEMPSTER & SONS'

RENOWNED

WOOD SIEVES,

WITH TAPER BARS,

MADE BY MACHINERY

CAPABLE OF MAKING 10,000 FEET WEEKLY.

References to Hundreds of First-Class Engineers.

ROSE MOUNT IRON-WORKS,

ELLAND, NEAR HALIFAX.

CATOPTRIC

STREET

LAMPS.

The NEW PATTERN

IS IN USE THROUGHOUT

CHEAPSIDE.

Mr. SKELTON,

37, ESSEX STREET,

STRAND.

LAMP-PILLARS,

GAS-LAMPS, FOUNTAINS.

Our New and Choice Designs for the above, with prices, are forwarded to any part of the world on receipt of twelve stamps. Estimates for work at home or abroad.

W. T. ALLEN & CO.,

(Late TURNER AND ALLEN), Established 1847,

GAS & WATER ENGINEERS & CONTRACTORS.

SOMERSET BUILDINGS,

LAMBETH HILL, UPPER THAMES ST.

(Late 203, Upper Thames Street), LONDON, E.C.

THOMAS TURTON AND SONS,

SHEAF AND SPRING WORKS,

SHEFFIELD,

MANUFACTURERS OF

FILES OF BEST QUALITY

FOR ENGINEERS,

STEEL OF ALL DESCRIPTIONS,

SCREW STOCKS, TAPS, AND DIES, SPANNERS

RATCHET BRACES, LIFTING-JACKS,

ANVILS, VICES,

AND ENGINEERS TOOLS GENERALLY.

LONDON WAREHOUSE:

90, CANNON STREET, E.C.

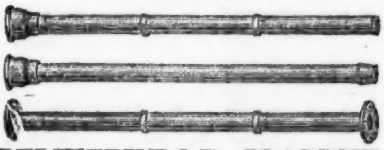
JAMES OAKES & CO.,
ALFRETON IRON-WORKS, DERBYSHIRE,
AND
WENLOCK IRON WHARF, 21 & 22, WHARF ROAD, CITY ROAD, LONDON, N.,
Keep in London and at their works large stocks of PIPES and CONNEXIONS (½ to 36 inches in diameter); also make and supply Retorts, Tanks, Columns, Girders, Special Castings required by Gas, Water, Railway, Telegraph, Chemical, Colliery, and other Companies.
CHARLES HORSLEY, Agent.

THE
SILICA FIRE-BRICK CO.,
OUGHTIBRIDGE
Near SHEFFIELD,
Manufacturers of THE ORIGINAL SILICA OR DINAS FIRE-BRICKS. Specially adapted for Gas-Retort Furnaces, and for Siemens's Gas-Furnaces. Shipments promptly executed to London, Liverpool, Hull, Grimsby, &c.

TROTTER, HAINES, & CORBETT,
BRETTELL'S ESTATE
FIRE CLAY & BRICK WORKS,
STOURBRIDGE.
Manufacturers of GAS-RETORTS, GLASS-HOUSE FURNACE & BLAST-FURNACE BRICKS LUMPS, TILES, and every description of FIRE-BRICK.
Proprietors of
BEST GLASS-HOUSE POT and CRUCIBLE CLAYS.
Successors to
E. BAKER AND CO., LATE BRIERLEY HILL, STAFFORDSHIRE.

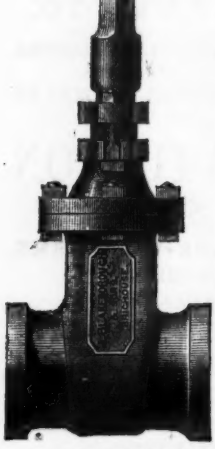
HARPER & MOORES,
PROPRIETORS OF THE
BEST STOURBRIDGE CLAYS,
STOURBRIDGE.
Manufacturers of all Descriptions of
BEST STOURBRIDGE FIRE-BRICKS, LUMPS, AND CLAY RETORTS
Of all Dimensions for Gas-Works,
GLASS-HOUSE POTS & CRUCIBLES
Of every kind.
The Highest Award was obtained by H. & M., at the Philadelphia Exhibition, 1876, for Superior Quality of Manufacture.

GAS AND WATER PIPES.
WILLIAM MACLEOD & CO.,
23 & 25, OSWALD STREET, GLASGOW.
CAST-IRON GAS AND WATER PIPES.



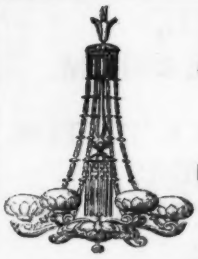
DELIVERY F.O.B., GLASGOW.
Prices on application.

SLUICE VALVES.
The STRONGEST, CHEAPEST, & BEST in the TRADE.
HYDRANTS.
The Largest Variety of Improved Designs in the Market.

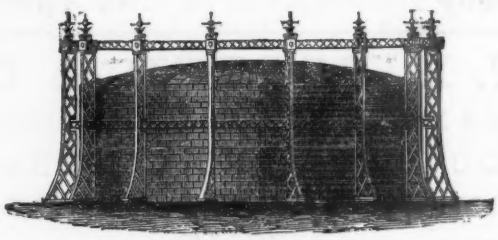


SPECIALITIES.
SLUICE VALVES for Water.
DO. for Gas and Sewage, 1½ to 48 in.
RESERVOIR SLUICES
AIR VALVES.
REFLUX VALVES.
BALL VALVES.
Compound HYDRANTS.
Straight-way Do.
Screw-down Do.
Ball Do.
Sluice-Valve Do.
STAND POSTS, various.
STREET WELLS.
STAND PIPES.
PATENT FIRE COCKS
STAND PIPES & JETS.
HOSE UNIONS and REELS.
LEATHER & CANVAS HOSE.
SCREW COCKS and FERRULES.
Tested with 600 to 2000 feet head of pressure.

J. BLAKEBOROUGH & SONS,
COMMERCIAL BRASS AND IRON WORKS, } BRIGHOUSE,
WOODHOUSE IRON WORKS, } YORKSHIRE.
Contractors to the British and Indian Governments.
LONDON OFFICE:
5, WESTMINSTER CHAMBERS, VICTORIA ST., S.W.,
Where Samples may be seen.



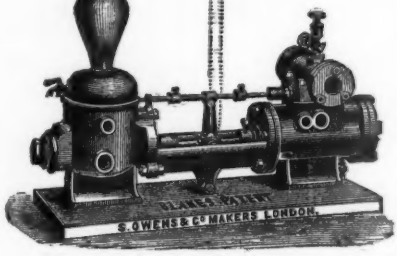
F. & C. OSLER,
45, OXFORD STREET, LONDON, W.
MANUFACTORY AND SHOW-ROOMS:
BROAD STREET, BIRMINGHAM.
ESTABLISHED 1807.
MANUFACTURERS OF CRYSTAL GLASS CHANDELIERS.
WALL LIGHTS, AND LUSTRES FOR GAS AND CANDLES.
TABLE GLASS OF ALL KINDS.
CHANDELIERS IN BRONZE AND ORMOLU. MODERATOR LAMPS.



THE HORSELEY COMPANY,
LIMITED,
TIPTON, STAFFORDSHIRE.
LONDON OFFICE:
6, WESTMINSTER CHAMBERS, VICTORIA STREET,
GAS ENGINEERS, IRONFOUNDERS, &c.,
MANUFACTURERS OF
GASHOLDERS, WROUGHT AND CAST IRON TANKS, CONDENSERS, PURIFIERS, SCRUBBERS, MAINS, RETORT-LIDS, PLAIN AND DISHED LAMP-POSTS, PIPES,
AND ALL REQUISITES FOR EITHER
GAS OR WATER WORKS;
ALSO
MAKERS OF ROOFS, BRIDGES, &c.

S. OWENS & CO.,
WHITEFRIARS STREET, LONDON, E.C.,
HYDRAULIC ENGINEERS,
AND MANUFACTURERS OF
PUMPING MACHINERY of every Description.
SOLE LICENSEES AND MANUFACTURERS FOR GREAT BRITAIN OF
BLAKE'S PATENT STEAM-PUMPS,
More than 10,000 in use,
ESPECIALLY ADAPTED FOR USE IN GAS AND CHEMICAL WORKS, FOR PUMPING TAR, WATER, AMMONIACAL LIQUOR, ACIDS, &c.
The following are some of the prominent advantages of the BLAKE PUMP:—

It will start at any point of stroke.
It has no dead point.
It works fast or slow, with the same certainty of action.
It is economical. Has a lead on the slide-valve.
It is compact and durable.



It is interchangeable in all its working parts.
It will deliver more water than any other pump.
It is made of best materials in the most workmanlike manner.
Can be worked at 20 strokes per hour, or 200 strokes per minute.

This Illustration represents Boiler-Feed Pumps, Sizes Nos. 1, 2, and 3, with Hand Lever for working Pump when Steam is not available.

SOLE MANUFACTURERS OF
MANN & OWENS
IMPROVED PATENT GAS-VALVES.

PRICED LISTS AND FULL PARTICULARS FURNISHED ON APPLICATION.

TANGYE BROTHERS AND HOLMAN,

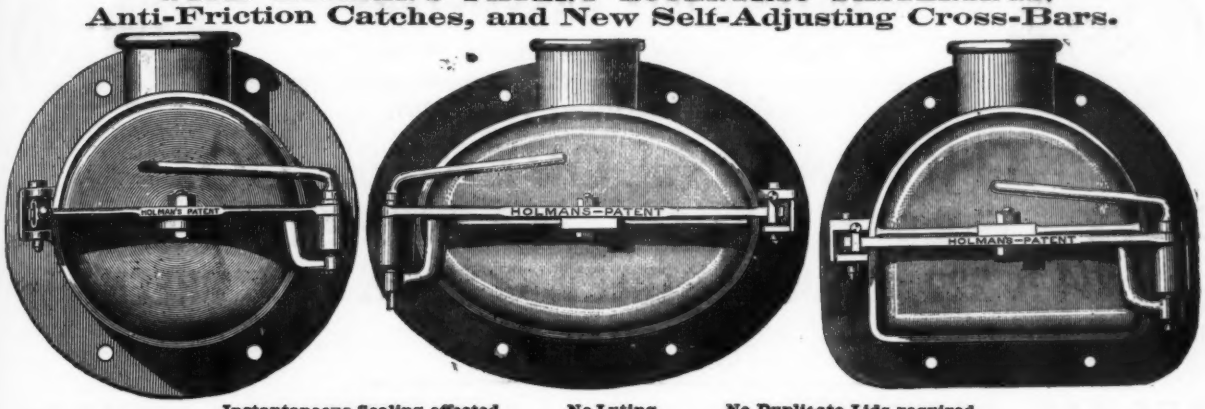
CORNWALL HOUSE, 35, VICTORIA ST., LONDON, E.C.

(LATE OF 10, LAURENCE POUNTNEY LANE.)

SOLE MAKERS OF MORTON'S PATENT SELF-SEALING RETORT-LIDS,

WITH HOLMAN'S PATENT ECCENTRIC FASTENINGS,

Anti-Friction Catches, and New Self-Adjusting Cross-Bars.



Instantaneous Sealing effected. No Luting. No Duplicate Lids required.

Holman's New Self-Sustaining Cross-Bar ensures freedom of Joint, and maintains parallel position of the Lids.

Since their introduction in 1869, these Patent Retort-Lids have been thoroughly tested, being now in use in nearly all the principal Gas-Works in London and the Provinces.

T. B. and H. are now making the "Morton's Self-Sealing Lid" of the SAME FORM OR SECTION AS THE RETORT (see Illustrations above), as well as bringing the Mouthpiece from the D or Oval at back to Circular in front, as heretofore.

D and Oval Morton's Lids are working satisfactorily both in this country, on the Continent, and in the United States of America. Among others they have been adopted by the following Gas-Works:—

The Gaslight Company's Works, Fulham; Ditto, Bromley-by-Bow; Ditto, King's Cross; Ditto, Shoreditch.
And also in the Gas-Works at Richmond, Maidstone, Gloucester, Glasgow, Portsea, Roubaix (France), The Hague (Holland

HUNT'S PATENT EQUILIBRIUM GAS-GOVERNOR.

In this Governor a Throttle-Valve is substituted for the ordinary suspended Cone, all external communications being avoided by placing the Lever or Radius Arm (shown in the drawing) inside the Valve-Chamber upon the Disc. The Disc is carried upon steel centres, upon which it is accurately balanced and turns freely. The friction in working is thereby reduced to a minimum. This Governor is extremely sensitive to alterations of inlet or outlet pressure, and renders a large actuating holder unnecessary.

The principal advantages of this arrangement over the ordinary form of Governor are as follows:—

Its sensitive action prevents oscillation.

It is self-adjusting—*i.e.*, it maintains a steady pressure under variations of inlet pressure or a fluctuating consumption.

The inlet to Gasholder being contracted to the smallest possible dimensions, all danger from leakage through insufficiency of seal, tilting, &c., is entirely avoided.

The valve portion being separate from the holder, it can be handled and fixed like an ordinary Slide-Valve direct in the main; and the holder can be placed at an convenient distance immediately above it. The cost is thus materially reduced, and the inconvenience of heavy lifts done away with.

There are no working parts likely to get out of order.

These Governors have been adopted by many leading Gas Companies, among whom are the following:—

The Gaslight and Coke Co. (9), The London Gas Co. (3), and at Abergavenny, Arundel, Birmingham, Cannes (France), Devonport, Dursley, Exeter, Guernsey, Halesowen, Mentone (France), Monmouth, Newcastle-on-Tyne, Oxford, Plymouth, Rochdale, Windsor, &c.

TESTIMONIAL.

The Gaslight and Coke Company,
9, Water Street, New Bridge Street,
Blackfriars, E.C., Feb. 27, 1875.

MESSRS. TANGYE BROTHERS AND HOLMAN.

Gentlemen,—The two 24-inch and three 36-inch Hunt's Equilibrium Governors supplied by you, and fixed in the valve-rooms at Whitechapel, Goswell Road, and Blackfriars, are working very satisfactorily.

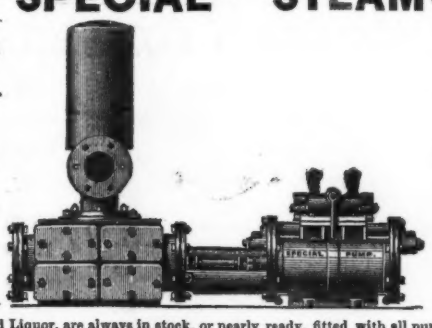
Yours truly,

(Signed) JOHN JOHNSON.

PRICES AND FULL PARTICULARS ON APPLICATION.

THE "SPECIAL" STEAM-PUMP.

Diameter of Steam Cylinder.	Diameter of Water Cylinder.	Length of Stroke.	Gallons of Water per Hour, Approximate.	Reduced Prices.
3	1½	9	450	£16
4	2	9	815	18
5*	2½	12	1,250*	20
5*	3	12	1,830*	22 10
4	4	12	3,250	25
6*	4	12	3,250*	30
5	5	12	5,070	32 10
7*	5	12	5,070*	40
6	6	12	7,330	40
8*	6	12	7,330*	50
7	7	12	9,750	50
10*	7	12	9,750*	65



In use in a Hundred Gas-Works in the United Kingdom for Pumping Ammoniacal Liquor, Water, or Tar.

Messrs. Burt, Boulton, and Haywood, Manufacturing Chemists, have over FORTY "Special" Steam-Pumps in use at their several large Tar-Works.

Two Hundred Sizes made. Those in Table opposite are the leading Sizes for use in Gas-Works and Chemical Works.

* These Sizes being usually selected for pumping Tar and Liquor, are always in stock, or nearly ready, fitted with all pump details in iron, and extra length distance-piece between steam and pump cylinder, at a small extra cost.

TANGYE'S HIGH-PRESSURE AND CONDENSING STEAM-ENGINES; CORNISH, VERTICAL, & TUBULAR BOILERS; HYDRAULIC AND SCREW LIFTING-JACKS, CRABS, PULLEY-BLOCKS, &c.

FULL PARTICULARS, ESTIMATES, CATALOGUES, ETC., ON APPLICATION.

London, 1851. New York. 1853. Paris, 1855. London. 1862.

Dublin, 1865.

The SIX MEDALS AWARDED to THOMAS GLOVER for

PATENT DRY GAS-METERS,

The latter being the Highest Medal awarded for Dry Gas-Meters by the Imperial Commissioners for the Universal Exhibition, Paris, 1867.

Paris, 1867.

THOMAS GLOVER & CO.,

DRY GAS-METER MANUFACTURERS,

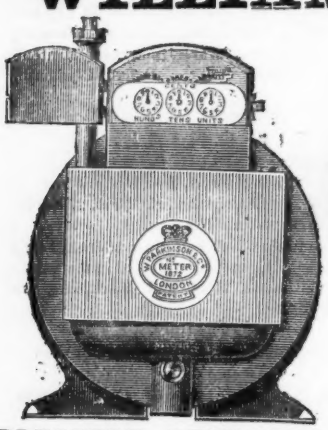
214 TO 222, ST. JOHN STREET, CLERKENWELL GREEN,

LONDON, E.C.

THOMAS GLOVER & CO.'S PATENT DRY GAS-METERS,

1st, Are a remedy for all the defects of Wet Meters;
2nd, Are suitable for all climates, whether hot or cold;
3rd, Incur no loss of Gas by evaporation;
4th, Cannot become fixed by frost, however severe;
5th, Are the most accurate and unvarying measurers of Gas;
6th, Prevent jumping or unexpected extinction of the Lights;
7th, May be fixed either above or below the level of the Lights;
8th, Cannot be tampered with, without visibly damaging the outer case;
9th, Will last much longer than Wet Meters;
10th, Will not cost more than one-half for repair that Wet or Water Meters do;
Are upheld for five years without charge.

WILLIAM PARKINSON AND CO.,



(ESTABLISHED 1816,)

MANUFACTURERS OF

WET & DRY METERS,

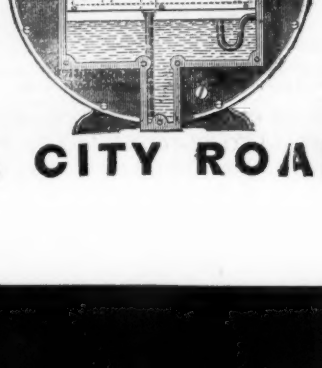
STATION-METERS & GOVERNORS,

EXHAUSTER REGULATORS,

PRESSURE REGISTERS, EXPERIMENTAL APPARATUS, GAUGES, WATER-METERS, &c.

HUNT'S PATENT IMPROVED COMPENSATING METER.

In this Meter, the action of the measuring-drum is reversed. By this arrangement an improvement is effected in the registration at high speeds, which, in many tests, has not varied from the smallest light to three times the capacity of the meter. It works equally well under all pressures. The range of error between the high and low line is much smaller than that allowed by the "Sale of Gas Act."



The Meter has been critically tested, and most favourably reported upon by official Meter Inspectors in London and Birmingham.

W. PARKINSON and CO. have made arrangements for the manufacture of these Meters, both in tin and cast-iron cases, and for the alteration of old ones to this principle, which is confidently recommended as possessing every quality that can be desired by Gas Companies, Corporations, or Private Consumers.

COTTAGE LANE, CITY ROAD, LONDON, E.C.

CONTENTS.

	Page
Circular to Gas Companies:—	
The Visit of the Gas Managers to Paris	9
The Exeter Gas Bill Passed	9
Proposed Trial of the Electric Light on the Thames Embankment	9
The Electric Light in France	10
The Metropolitan Board of Works and the Quality of the London Gas	10
The Leicester Corporation Bill	10
The Birmingham Exhibition of Gas Apparatus	10
Opinions as to Water Gas	10
Election of Mr. Hawksley as a Fellow of the Royal Society	10
Water and Sanitary Notes:—	
The Annual Report of the Metropolitan Board of Works on the Water Supply	10
The Hydrant System in the City of London	10
How to Dispose of Town Sewage	11
Leading Article:—	
Birmingham Exhibition of Gas Apparatus—The Residuals Obtained in the Manufacture of Gas	11
Communicated Article:—	
On the Proportions of Gas Condensers. By Mr. W. H. Y. Webber	12
Correspondence:—	
Sewage Gas	15
Leakage	15
Parliamentary Intelligence:—	
Progress of Bills in House of Lords	15
Public Health Act (1875) Amendment Bill	15
Progress of Bills in House of Commons	16
House of Lords Committee—Radcliffe and Pilkington Gas Bill	16
House of Commons Committee—Exeter Gas Bill	16
Miscellaneous News:—	
Growth of the Petroleum Trade	12
Meeting of the Malta and Mediterranean Gas Company	17
Sales of Provincial Gas Shares	18
Meeting of the Chelsea Water Company	19
Gas and Water Companies Directory, 1878	19
British Association of Gas Managers	20
The Registrar-General on the Water and Gas Supply of London	26
Water Gas in America	26
Trade Reports	26
Reductions in the Price of Gas	27
Street-Main Joints	27
Register of New Patents:—	
Hallewell, R.—Gas Motor Engines	27
Wirth, F.—Filling for Gas-Meters	28
Trull, C. K.—Lighting Gas	28
Applications for Letters Patent	28
Share List of Metropolitan Gas and Water Companies	28

TO SUBSCRIBERS.

An Index and Title-Page to the First Half-Yearly Volume of the JOURNAL for 1878 are furnished with this number, and cloth cases for binding may be obtained on order from any bookseller, or from the office; but the Publisher cannot receive the numbers of the JOURNAL to bind for Subscribers.

Subscribers who desire to avail themselves of the reduction in the subscription to the JOURNAL by paying in advance for the second half of the year 1878, are reminded that this can only be done during the present month.

Subscribers who have not paid their subscriptions for this, or for any previous year, are requested to remit the same forthwith to the Publisher, in order to prevent any interruption in the regular delivery of the JOURNAL.

TO CORRESPONDENTS.

No notice can be taken of anonymous communications. Whatever is intended for insertion, must be authenticated by the name and address of the writer; not necessarily for publication, but as a guarantee of good faith.

THE JOURNAL OF GAS LIGHTING,
WATER SUPPLY, & SANITARY IMPROVEMENT.

TUESDAY, JULY 2, 1878.

Circular to Gas Companies.

COMMUNICATIONS forwarded to us by esteemed correspondents tell us that the visit of the Members of the British Association of Gas Managers to Paris, as might have been expected, has been of a most enjoyable character. The Members were met on their arrival by a deputation from the Société Technique, from whom they received a hearty welcome. The next day was devoted to a visit to the Pavilion in which the Paris Gas Company make such a complete and magnificent display of their apparatus and products. We, who have so continuously urged upon large English Companies the desirability of working up residuals, need hardly point out that this part of the Exhibition must have had peculiar interest to the Managers. They had the next day the opportunity of seeing the manufacturing operations, other than those of gas-making, in active work at La Villette, and must have been struck with what they there saw. The subsequent visit to Ivry, and the opportunity of examining the working of Siemens's furnaces, must have opened up new ideas to some English minds. The day may come, after this visit, when these furnaces will be more appreciated in England. We express no opinion respecting them, beyond what we find recorded by authorities whom we regard as competent. We may be told that now, while fuel is cheap, the use of a regenerative furnace is not economical; but more than economy in fuel is said to result from the Siemens furnace. The great recommendation of it is the even heating of the setting, which equalizes the production of gas from each retort.

The festivities, it seems, were very agreeable. The Paris Gas Company, at Ivry, were most liberal in their entertainment of the visitors, and the banquet of the Société Technique, on the Ile du Lac, in the Bois de Boulogne, was perfection. It gratifies us very much to find that, notwithstanding differences of language and race, the same sentiments actuated both. All present are engaged in the manufacture of gas; their sole object is to advance the art, for their own honour and to the advantage of their employers.

Of the meetings of the Société Technique, at which our friends took part, we can at present say but very little. We shall, by-and-by, have full reports of the proceedings; it is sufficient now to say that England held her own, and that the Members of the British Association of Gas Managers had a fair share in the discussions. We are half disposed to regret that the visitors were not invited to the works at St. Mandé, which we believe are the largest belonging to the Company. Taking it altogether, however, this visit to Paris has been a great event. The number of Members who visited the French Metropolis was larger than we expected, and we shall here make no remarks attributing parsimony to either Corporations or Companies, which stood in the way of the attendance of a larger number. Of this we are quite certain, that no intelligent Gas Manager can have gone to Paris without coming back with a head full of ideas, the elaboration of which, in the quiet retirement of the modest homes which Companies and Corporations usually allow their Managers, will result in designs of the utmost importance to those interested in the manufacture of gas.

In our "Circular" for the 26th of March it was remarked that, "It may now, we think, be taken for granted that the "works of the Exeter Gas Company will soon pass into the "hands of the Corporation." At the same time, we mentioned certain terms of purchase that had been offered a few days before by the Exeter Corporation, and which were characterized in our columns as "ridiculous," and denounced as altogether antagonistic to the interests of "unoffending shareholders." We may say here that we never express any opinion upon terms of purchase before they are settled by authorities whom it may be expected we cannot possibly influence. We may mention, however, that the Bill of the Exeter Gas Company was last week before a Committee of the House of Commons, and in the course of a very short time it was arranged between the contending parties that the Bill should pass, with the proviso that a clause should be inserted giving the Corporation the power to notify to the Company, within a month after the Act had received the Royal Assent, that they were desirous of purchasing the undertaking. Before consent was given to the passage of the Bill in this form, an agreement had been come to for the purchase of the works; and, strangely enough, on terms which closely agree with those we announced on the 26th of March. They are that the Corporation shall pay to the Shareholders annuities equal to maximum dividends, which may, as usual, be redeemable at twenty-five years purchase; then, as a matter of course, the Corporation are to take over the mortgage and debenture debts of the Company; and they are further to reinstate the reserve and contingency funds, amounting to £7750, which, *minus* a sum of £2400 for the site of the old works in Tudor Street, will be divisible amongst the Shareholders; and, further, the sum of £1500 is to be paid as compensation to the Directors for loss of office and trouble in winding up the affairs of the Company. As regards the debts and liabilities, the Company are to bear all incurred up to the 30th of June, on which date the transfer, if it take place, will happen. We are not, of course, in the secrets of the Exeter Corporation, but we imagine that the statutory notice will be given within the required time, and that the Exeter Gas Company will pass out of existence. We shall say nothing about the fairness or liberality of the terms of purchase, but it may be intimated again that the Exeter Corporation will, perhaps, have the opportunity of manufacturing gas in a manner which will not prove a nuisance to the citizens, and at a charge which will satisfy them. It need hardly be added that we look with regret at the disappearance of one more Company established upon commercial principles.

The Members of the British Association of Gas Managers who have visited Paris have been greatly pleased with the electric light, as applied to outdoor illumination. We are not surprised at this, for the effects are undoubtedly brilliant; but we do not at the present moment know the exact cost at which they are obtained. The Metropolitan Board of Works, however, seem to be disposed to put the matter to the test in London. There is a proposal before the Board to light up the

Thames Embankment, or a portion of it, by means of some electric lamp. It does not seem to have been settled whose invention, out of the several which are now in existence, shall be adopted; but we have no doubt the experiment will be tried, and we have no objection to it. We may, however, express a hope that the Board will not expend the money of the ratepayers on experiments of this kind. They have only to hold up their finger, and more than one Company will rush forward to demonstrate to them that the electric light is the one illuminating agent for public places. We are somewhat sorry that Trafalgar Square has not been selected for the demonstration; for, to our innocent minds, facilities exist there which are not to be found on the Embankment.

M. Hippolyte Fontaine delivered a very interesting lecture, on Electric Lighting, to the Members of the Institute of Mechanical Engineers, who, a week or two ago, paid a visit to Paris. It seems that the light is being somewhat rapidly brought into use in France, mainly for the illumination of workshops and large spaces. In 1874 four applications of the light had been made in industrial establishments. In the present year it is said that over five hundred factories, &c., are illuminated by means of electricity. The lecturer was careful to point out that the gas industry has nothing to fear from the competition of the electric light, and we may mention that the electric light has a far better chance in France than with us. In calculating the relative cost of gas and the electric light, in the large weaving-shed at Rouen, the lecturer has to set down the price of gas at something over 7s. per thousand feet, and yet the use of six Gramme machines in substitution of one hundred and sixty burners, each consuming five and a half feet per hour, only produced a saving of £57 3s. in the year. It is clear, then, that with gas at 3s. 6d. per thousand feet, little or no pecuniary advantage could be gained by the change. We say nothing here about the character of the illumination—that is, to a great extent, a matter of taste; but we shall not pretend to conceal an opinion, often, by the way, expressed before, that there is a wide field for the application of the electric light in this country.

The remarks we made the week before last on the report of the Metropolitan Board, as regarded the quality of the London gas supply, were founded upon a newspaper paragraph, for we had not, at the time, the full report with which we have since been graciously furnished. In this document we find that the Board do acknowledge that the gas supplied by the three Companies under the supervision of their Examiners, "has been "throughout the year generally equal, in point of purity and "lighting power, to what is required of them." It ought to have been said "almost invariably," instead of "generally;" for the few instances in which the Companies have made default were remarkable exceptions.

The Leicester Corporation (Gas, Water, and Improvement) Bill passed the House of Lords after the insertion of a clause which, when it came down to the Lower House, was regarded as an infringement of the privileges of the Commons, inasmuch as it dealt with the money question. The matter was speedily put right; and after Mr. Raikes—the Bill being unopposed—had reduced the number of years in the course of which the debt is to be extinguished, the Bill was reported, and has since passed. We shall presently have a full account of what transpired, and we shall then be able to give a further notice of the proceedings, which appear to us to possess much interest.

We were pleased to find, from the letter of Mr. Smith, which we published last week, that the exhibition of gas apparatus at Birmingham was much more successful than we thought it would prove from the short visit we could pay to it. It is encouraging to find so much interest taken in a display which appeals, we may say, mainly to the intellect. The eye is not dazzled by looking at a gas-cooking stove, except such a one as the open roasting-stove shown at Birmingham. We hope the free cooking lessons will have proved useful to the wives of the Birmingham artizans, for it is amongst this class that the benefits and cheapness of gas cooking will be most felt and appreciated, if they could only be at once convinced of the economy.

Water gas, as it is manufactured by the Municipal Gaslight Company of New York, may possibly some day compete with coal gas in this country. We publish to-day two letters addressed to the President of the above-mentioned Company—one from Dr. E. Frankland, and the other from the celebrated chemist of Paris, Mons. A. Würtz. Both these gentlemen express unqualified approval of the gas in question, and seem anxious to have it introduced into their respective countries and homes. In our opinion, both underrate the possible dangers which may arise from the use of the gas. With a distinct odour which would at once give notice of an escape, and with a density which would prove an obstacle to rapid leakage, it might be supposed that most of the danger would be avoided; but we must confess that we should not care to introduce into our own house a gas containing nineteen or twenty per cent. of carbonic oxide. This gas we regard as eminently poisonous and dangerous. It does not simply produce coma, from which recovery is possible after many hours, but it acts on the blood corpuscles in a specific manner, and so makes recovery from its effects extremely doubtful. There is another point which we may mention once again, and it is that the extensive use of the light petroleum oils would soon render them too expensive for the gas to compete with that manufactured from coal. There is one more consideration, and it is that the employment of the oil would tend to diminish the cost of coal, hence we consider that our industry, as it stands, and as it may be improved, is safe from all successful competition.

The announcement is made that Thomas Hawksley, Esq., C.E., the eminent Engineer, has been elected a Fellow of the Royal Society. We regard this as a somewhat tardy recognition of this gentleman's great merits, for it must be admitted that some others of less standing in his profession have enjoyed this distinction for some years. We may, however, congratulate Mr. Hawksley on his admission to our chief learned Society—an honour which he perhaps himself did not seek.

Water and Sanitary Notes.

The Report for the past year of the Metropolitan Board of Works necessarily, from the date of its presentation, gives only a prospective view of their intentions with respect to the Water Supply of the Metropolis. We now know that the Board failed to obtain any of the powers for which they applied. The dual supply was, we think, properly declined by nearly every Local Authority in London. To say the truth, less objection was made to the Purchase Bill than to the measure which was promoted to give a second, and compulsory, supply of hard water, at high pressure, for the extinguishing of fires and for drinking and culinary purposes. This ill-advised measure failed to obtain any popular support, and although it reached a second reading in the House of Commons, it was eventually withdrawn. We do not expect to see it revived, for the alleged advantages which could possibly be derived from the inauguration of a second supply we regard as problematical. No additional supply for the extinction of fires is required, for we read in this report that in the course of the past year only a little more than fourteen and a half million gallons were used for that purpose, and that nearly one-half was taken from the river, canals, and docks, and the remainder from the mains of the Companies. There was a short supply in only nine instances, thirty-three late attendances of turncocks, and nine no attendance; for the two latter the Board are entirely responsible. If they had acceded to the proposal of the Water Companies, and lodged a turncock at every Fire Brigade station, it is quite certain that no delay could, in any case, have occurred. The reasons the Board had for not accepting the proposal of the Companies have never been made clear to us, and we can only suppose that the refusal was dictated by a desire to keep a statement in their annual report like that just referred to. This unseemly antagonism is not creditable to the Board, who profess to have such a desire for the early extinguishing of fires.

The hydrant system is being rapidly extended, without any assistance from the Board, who can, however, offer no opposition. The Companies east, south, and north give their notices, and carry out their works, while the Board sit sulky and silent. A policy of this kind does not redound to their credit, and we are certain that their abstinence from furnishing any help in carrying out the provisions of the Act of 1871 will not be allowed to escape the attention of the Legislature whenever they attempt to obtain the control of the Metropolitan Water Supply. A public-spirited policy would have dictated a hearty co-operation with the Companies in every effort to promote the general welfare; but, at all events, in the matter of fire extinction, the Board seem to have been determined to be simply obstructive. They may be said to have had their reward. Next year, if the Eastern Question be comfortably settled, and a strong Conservative majority be secured at a general election, the Board will probably lose their control over the Fire Brigade; and we are quite certain that Sir J. Henderson will not object to give lodgings to turncocks at the expense of the Water Companies.

We are very much afraid, from what reaches us publicly and privately, that the Corporation of the City of London are not taking sufficient pains to get their police instructed in the situation and use of hydrants. It is all very well to put down hydrants; but unless there are persons who know where they are placed, and are competent to bring them into action, the

hydrants are simply shams. Parts of the City, it would appear, are, at the present time, very badly protected from fire. The Brigade stations are distant, and nobody knows exactly where hydrants are to be found. We are doubtful whether there is or is not a Fire Brigade station within the area of the City of London. If there be not, a paramount duty has been shamefully neglected. The Corporation may be, perhaps, as much to blame for this as the Metropolitan Board of Works. In any case, the mistake of leaving the City without the means of protection from fire, until the hydrant system is fully brought into use, should be promptly rectified. [We learn that there is a manual engine, with six men, stationed in Watling Street; and that is all the protection the Metropolitan Board give to the City of London.]

The doubt which still prevails as to the best means of disposing of town sewage has provoked Dr. Lush to give notice that he would, on an early date, call attention to certain provisions of the Rivers Pollution Act, and move—

"That, considering the extreme uncertainty which still prevails as to the best and most economical way of disposing of sewage, this House is of opinion that it is unjust to subject certain towns to the serious expense and inconvenience of entirely changing their system of drainage when that system can be shown to be working satisfactorily, and to have been carried out under the sanction of the Local Government Board."

The motion is a very proper one, for many towns and cities are doing their best, but, even at the best, fail to comply with fanciful requirements of *doctrinaires*. We regard Dr. Lush's motion as of great importance, for there is a strongly antagonistic feeling on the part of some riparian proprietors, who wish everything to be done at once, and will not allow Local Authorities time to elaborate and complete the experiments upon which they have entered. It will be many years before the Sewage Question is definitely settled. In the meantime, precipitation and irrigation schemes must have a fair trial. Time and experience alone can show which is the better, and when that is settled we may resort to compulsion.

BIRMINGHAM EXHIBITION OF GAS APPARATUS.

The Residuals Obtained in the Manufacture of Gas.

A peculiar and important feature of the late Exhibition at Birmingham was the series of specimens illustrating the various products derived from the residuals of gas manufacture. Apart from their commercial value, these specimens were of more than ordinary interest, as illustrating how vast and incomprehensible are the resources of nature. In the beautiful crystals, snow-like salts, and iridescent colours were exhibited the results of chemical actions that had exerted their power myriads of years before man or even animals had existed on the surface of our globe. One of the gases, given off by the cooling down of a mass of heated matter, which floated over the slowly emerging land, was the carbonic acid which had formed the food of some monster fern or giant stigmaria, and eventually became carbon. This selfsame carbon, after lying entombed for countless ages, was, by the skill and energy of man, torn from its long resting-place, and, as fuel, has given back heat, and food, and life to a new order of organized beings. In the coke and tar were seen the results of these stupendous operations. Then in the salts derived from the ammonia were to be seen other proofs of Nature's thrift, for in them we have the elements of the atmosphere of that far-off period. The moist and humid vapour furnished the hydrogen, and the nitrogen of the heavy air supplied the other ingredient, which was destined in these later times to furnish man with important aids to his industrial and commercial requirements, supplying him with means by which he might promote his health and well-being, and furnishing him with the food by which to sustain his very existence, for to all these purposes can ammonia and the compounds derived from it be applied.

But, besides these, the very rays of light that fell upon these old, old woods and forests of the past once more become visible, and the chemist of to-day, by his cunning craft, unlocks this storehouse of nature, and gives back to the world the very colours that might have glowed in pristine brilliancy in days so far remote that we cannot reach them even in thought, much less compute them. This is no fanciful picture or poetical rhapsody. The colours produced from the residuals of a gas manufactory are as real as those derived from the indigo or dye woods growing to-day—the madder root cultivated by a Spanish husbandman, or the cochineal insect feeding on a Mexican cactus. Even the most noxious elements of some substances are, by the far-reaching economy of nature, made to serve a beneficent purpose. The sulphur and cyanogen derived from the coal are in their turn converted into valuable compounds, which are indispensable in an almost infinite variety of manufacturing and industrial pursuits.

The celebrated chemist Liebig once said "that the prosperity of any country might be fairly ascertained by the quantity of sulphuric acid it used." If such be the case, the sulphur which may be extracted from the spent oxide and other purifying materials of our gas-works, should play a very important part in promoting the prosperity of this country. In the valuable compound prussian blue we have the utilization of another poisonous ingredient—the cyanic acid which is always present in more or less quantity in the residuals of every gas-works.

If the foregoing remarks be true, then it will be evident that in an inspection of the products from gas-works there may be gleaned some insight into the way in which this earth of ours has been built up and organized, and how each particle of which the vast fabric is composed is made to play its part and tend to keep the whole in a state of order and equilibrium.

But to the practical gas manufacturer the study of these residuals should assume an importance that can never be appreciated by the mere casual observer. As the demand for gas increases, so must the amount of the residuals consequent upon its manufacture be greatly augmented, and their profitable conversion into saleable commodities demand more and more attention. For many years the question of disposing of the crude residuals, such as tar, ammoniacal liquor, and spent purifying material, has been one simply of sale to some outside manufacturer, who has made his contract to purchase them for a specified term, at a given price for a given strength; the only obligation resting upon the gas manufacturer being that of storeage for a time, and affording facilities for their removal. In a great majority of small works, and even in some large ones, this arrangement must still be carried out as the only one by which the tar and ammonia water can by any possibility be profitably treated. But it is worth considering by those Companies and Corporations who have already erected, or are contemplating the construction of works on new sites, or of occupying enlarged premises, whether the working up of the residuals should not form a component part of their process of gas manufacture. The technical management of gas-works is essentially to conduct a chemical process. The material to be operated upon is a complex body, made up of a variety of elements, and it is to change the relative positions of these elements towards each other that is the object of the manufacturer. It is, therefore, quite certain that just in proportion as the individual who directs the work comprehends the nature of the material he is dealing with, and the influence certain forces have upon such a material, will be the success of his operations. To eliminate the light-giving constituents of coal is the primary object of the gas manufacturer, and the more light he gets, the nearer he approaches perfection in the execution of his work. But as the coal contains other elements than those of light, it is necessary, in order to preserve what is valuable in these latter, that the process of evolving the light shall be so conducted as not to materially injure them, and hence the value of chemical knowledge to the gas manufacturer becomes most apparent, because, by its aid, he will be the better able to adjust each step in his proceedings, so as to obtain the largest aggregate of benefit without injury to that which is the principal object of his operations.

It is from this point of view that it appears of importance to all who manufacture gas on a large scale, that they should deal, as far as possible, with all the products derived from the coal, for the following among other reasons:—The chemical knowledge absolutely essential for the perfection of gas manufacture is that best qualified to deal successfully on a large scale with all the other ingredients contained in the coal. Distillation, sublimation, evaporation, condensing, washing, refining, and purifying are all chemical manipulations necessary to the successful treatment of the liquid residuals of gas-works, and they are all processes with which the Manager, in the exercise of his daily duties, has become perfectly familiar. No special education, therefore, ought to be necessary to fit him for the supervision of the requisite operations. There appears, however, a far more cogent reason in the fact that in dealing with the tar, if sold to a contractor, it is almost necessary to leave in it some appreciable quantity of the naphthas and lighter hydrocarbons, for, without these, tar distillers, as a rule, are not very ready to take the risk of entering into contracts. A question which is beginning to force itself upon the attention of gas manufacturers is, whether they ought not to retain in the gas all these illuminating constituents, or, at least, as many of them as they can, and be content to deal with the tar after these naphthas and light hydrocarbons have been taken from it. That the Companies themselves can deal with their tar thus, does not admit of a doubt. With comparatively simple additions to works built in open situations, they would be able to convert all the tar into forms less bulky for transport, and far more easy of storeage.

Another matter also worthy of consideration is whether, after the naphthas have been extracted, there does not remain behind material capable of furnishing very valuable fuel, without using the absolute pitch or heavy oils. The extension of the use of wood for street-paving must involve the consumption of large quantities of pitch, and the possibility of substituting artificial asphalte for stone in foot-paths, floors of courts, and a variety of other paving purposes, must of necessity increase the demand for the ultimate tar products, so that Companies may be sure of a market for it, even though it has been deprived of all its more volatile constituents. Such a procedure as the one suggested is, no doubt, a departure from established practice, but altered circumstances often render change of action necessary.

What has been said in reference to the tar will also apply to ammoniacal liquor, and frequently to spent purifying material, but especially the former. There cannot be a doubt that the increased chemical knowledge brought to bear on the process of gas manufacture points most unmistakeably to the use of the ammonia derived from the distillation of the coal as a means of extracting some of the impurities which crude coal gas contains. It may be questionable if ammonia alone can furnish a complete substitute for all the agents now employed in the purification of gas; but commercial experiments show it can be successfully used to take out one important obstacle to perfect purification, that of carbonic acid. By doing this it enables the lime or oxide of iron to complete the process far more effectively. But, even assuming that ammonia may not be adopted as a purifying agent, the question still remains whether the ammonia products of gas distillation cannot be treated far more

economically and advantageously by the gas manufacturer himself than by sale in the crude state. The outlay for storeage tanks, of sufficient capacity on the works, the labour and cost of transporting so much useless material in the shape of water, would all, or nearly all, be saved, if the liquor were treated on the spot. There is always a considerable amount of waste heat at disposal on gas-works, which only requires skill and perseverance to turn to useful account.

But there is another element which should be taken into account, and that is the tendency there is on some works to wash too much, in order to raise the liquor to a saleable strength. It is true there exists a great diversity of opinion as to the influence upon gas of frequent washings, in removing some portion of the light-giving constituents. That gas obtained from one class of coal will suffer less deterioration than that derived from other varieties is a well ascertained fact, but the real question at issue is whether all gas—and especially that made from a mixture of coals—would not retain more of the light-giving elements if the mechanical friction, caused by washing and scrubbing surface could be diminished. It is a well-known fact that the purification of many liquids takes place by the mere subsidence or precipitation of the suspended matter. The same should occur in aëriform fluids, placed for a time in a state of rest, but the present mode of manufacturing gas renders a system of purification by precipitation impracticable. Still, is it desirable to go to the other extreme, and drive the gas under a heavy pressure into contact with surfaces that may remove some of its most valuable ingredients? If the washing and scrubbing liquors in gas-works were less concentrated, and made to move slower, they would be more effective in removing absolute impurities; but as they would be less valuable as saleable commodities, so their efficiency in one direction is sacrificed in order to increase their value in another. If, however, they were treated on the works, the absolute quantity of their nitrogenous compounds would be extracted, the only real difference being that these compounds would have been distributed through a larger quantity of otherwise useless water.

In suggesting the desirability of gas manufacturers dealing directly with the liquid residuals, there is no desire to import extraneous commercial enterprises into the process of gas-making, and it would be a question if it is desirable that all the subsequent processes of refining and absolute preparation of all the salts or fluids capable of being produced from the crude residuals should or should not be carried on upon the premises of the gas manufacturer. This must, in a great measure, depend on local and other circumstances. All that is contended for in these suggestions is that, taking into account the primary object of every gas-works—viz., that of producing light—all the processes adopted should be made to converge to this point, and that every residual should be so dealt with as to promote the best results—that of obtaining the most light from the coal used.

An objection may be raised to the course suggested in the foregoing remarks, on the ground that it would require extensive chemical knowledge to successfully deal with these residuals in the way pointed out; but should such an objection apply any more to the selection of an Engineer or Manager of gas-works, than to the class of knowledge requisite for an Engineer of an important line of railway? The latter, to be competent to discharge the duties of his position, must combine the skill of the Architect with that of the Civil and Mechanical Engineer. So the Engineer of gas-works becomes better qualified for his post in proportion as he combines a knowledge of mechanics and construction with the technical information of the practical chemist. The class of chemical knowledge necessary is not that species of dilettanteism which confounds the ability to make a few pretty and toy-like experiments with the knowledge necessary to control extensive and complex manufacturing operations. We never have, nor ever shall cease to urge upon the proprietors of gas-works the importance of securing the services of men who have the best scientific knowledge of the work they have to do, feeling quite sure that to have such men in their employ will be the surest safeguard against injury to their property from outside agitation.

The recent Exhibitions at South Shields and Birmingham have called attention to several important matters relative to what may be the future of gas; but not the least important, it is believed, will be the treatment of the residuals obtained in gas manufacture.

Growth of the Petroleum Trade.—The production of petroleum as an article of trade dates from Aug. 28, 1859, when Colonel Drake, in a well 69½ feet deep, "struck oil," and coined a phrase that will last as long as the English language. From that beginning it has increased to an annual production of 14,500,000 barrels of crude oil. The first export was in 1861, of 27,000 barrels, valued at 1,000,000 dollars, and the export of petroleum for the year 1877 was, in round numbers, 62,000,000 dollars. The annual product of petroleum to-day—crude and refined—is greater in value than the entire production of iron, and is more than double that of the anthracite coal of the State of Pennsylvania, and exceeds the gold and silver product of the whole country. As an article of export, it is fourth, and contests closely for the third rank. Our leading exports are relatively as follows:—Cotton, annually, from 175,000,000 dollars to 227,000,000 dollars; wheat flour, from 69,000,000 dollars to 130,000,000 dollars; pork and its products (bacon, ham, and lard), from 57,000,000 dollars to 82,000,000 dollars; and petroleum, from 48,000,000 dollars to 62,000,000 dollars. The total export of petroleum from 1861 to and including 1877 (16 years) has been 442,698,968 dollars, Custom House valuation. From the best sources of information there are at this time 10,000 oil wells, producing and drilling, which, at an average cost of 5000 dollars per well, would make an investment of 50,000,000 dollars in this branch of the business. Tankage now existing of a capacity for 6,000,090 barrels cost 2,000,000 dollars, and 7,000,000 dollars have been invested in about 2000 miles of pipe lines connected with the wells. The entire investment for the existing oil production, including purchase-money of territory, is something over 100,000,000 dollars, which amount cannot be lessened much, if any, for as wells cease to produce new ones have been constantly drilled to take their place.—*The Lumberman's Gazette.*

Communicated Article.

ON THE PROPORTIONS OF GAS CONDENSERS.

By Mr. W. H. Y. Webber.

The object of this paper is to examine the principles upon which the process of condensation of coal gas is based, and, upon the general laws deducible therefrom, to formulate an exact and reliable method of proportioning the apparatus required.

That such a method is necessary may be perceived on the most cursory examination of the rules commonly laid down in published works on Gas Engineering, which give a rough-and-ready statement of the condenser superfices to be allowed for every thousand cubic feet of the maximum daily production of gas, without furnishing any reasons for their *dicta* other than general practice. This is not by any means a trustworthy guide in such matters, as may be seen from the fact that "Hughes's Treatise," published in Weale's series, gives 4 feet as the proper area, and "King's Treatise," now in course of publication, under the auspices of the Journal of Gas Lighting, gives 10 feet as the latest datum in accordance with the best modern practice.

This enormous difference would need some explanation if both data were based on any intelligible or ascertained formula, but as they are professedly the results of observation, we must conclude that, if they are both correct, as they probably are to a certain extent, the practical examples on which the analytical observations which led to their enunciation were made, were either very dissimilar in design, or were subjected to some unperceived disturbing influences, which have vitiated the observed proportionate results, and rendered them mere approximations instead of authoritative rules deduced from truly scientific experiment and research.

I shall endeavour to show that, by careful consideration of the work which a condenser is required to do, one can easily determine the most suitable means by which that work can be done, and then, by taking account of the actual amount of work to be done in any given instance, the proper means can be duly provided; or, in other words, the necessary apparatus can be properly proportioned. I propose to consider the work of a condenser in three distinct aspects—viz., thermal, mechanical, and chemical; for an efficient apparatus simultaneously cools the gas, precipitates the condensable vapours it holds in solution or suspension, and cleanses it from a proportion of gaseous impurity; and as these three duties have important relations with each other, and affect the whole process, they must be separately considered and provided for.

Before proceeding to treat of the thermal action, it will be well to explain the method by which this, the most obvious portion of the work of a condenser, is to be measured. This investigation belongs to the science of heat, as explained in the works of Tyndall, Péclet, Dulong, Regnault, Pouillet, Box, and others, from which the tables and experimental data herein used have been taken, and to which I must refer those who wish to prosecute more thorough inquiries into this branch of my subject than I have deemed essential for the particular object in view. I shall merely state a few preliminary matters belonging to the elements of this science which must be borne in mind in following the calculations which will be shown.

The measure of thermal effects in this country is "the unit of heat." This may be explained as being that fixed amount of heat which is necessary to raise the temperature of 1 lb. of pure water 1° Fahr. This quantity will be continually referred to in the following calculations, and a simple example will, perhaps, serve to fix it completely in the mind; thus (Ex. 1), to raise 100 lbs. of water from 50° to 75° Fahr. will require $100 \times 25 = 2500$ units of heat.

The term "specific heat" will also be found constantly used. This means the *absolute capacity* of a body for heat. Thus, water being the standard, some bodies will require more units of heat to raise them to a given temperature than is the case with water, while others will require less. The specific heat of several common bodies has been observed to be as follows:—

Table I.

Cast iron	·1298
Copper	·0951
Glass	·1976
Olive oil	·3096
Water	1·0000
Gases under 30 in. Constant Pressure of Mercury.	
Oxygen	·2182
Nitrogen	·2440
Carbonic acid	·2164
Sulphuretted hydrogen	·2423
Air	·2380
Aqueous vapour	·4750
Hydrogen	3·4046

The application of this table shows that, supposing it to be 100 lbs. of copper which is to be heated 25°, it would only require $100 \times 25 \times ·0951 = 237·45$ units of heat, as against 2500 units in the case of water.

When we pass to the consideration of gases, with which we shall have more particularly to deal, we are struck with the surprising capacity for heat which is shown by hydrogen. The amount of heat which would be required to raise 100 lbs. of this gas 25° is no less than $100 \times 25 \times 3·4046 = 8511·5$ units. When we have to cool a body, we have to remove from it a precisely equal quantity of heat to that which it absorbs when it is heated through a corresponding range, and, therefore, the same value has to be given to its specific heat, and a precisely similar calculation must be made.

The thermal duty of a condenser, then, consists in its cooling action

on the contained gas, and, in ordinary practice, it may be assumed that the absolute work of any such apparatus will be expressed by the reduction of the temperature of the unpurified gas which passes through it from 120° to 60° Fahr., which may be taken as the lowest point to which the cooling action should be carried. The definite dimensions of the apparatus will entirely depend upon the particular quantity of gas to be treated in each individual case, which is generally expressed by the number of thousands of cubic feet per hour of the maximum production.

It is evident that if the gas to be cooled were perfectly homogeneous and dry—as air, for example—the problem to be solved would be greatly simplified, and we should merely have to discover the form of apparatus which would effect the desired reduction of temperature in the shortest and most direct manner, without troubling ourselves about any other considerations. But so far from this being the case with gas in its first condition, as we have to deal with it, we find that it is a most complex jumble of a great many bodies having widely differing characters and constitutions, more or less intimately mingled. Perhaps the most noticeable of the extraneous matters, from their disturbing influences, are the vapours of water and tar, which are present chiefly in a state of mechanical suspension, hurried forward, as we may say, by the current of gases, which are at a temperature lower than that necessary to evolve them from their respective generating fluids, and, consequently they are being constantly deposited in their liquid form on the interior surface of the apparatus, from which they must be removed in a convenient manner. It is in this connection that the mechanical aspect of the condenser is manifested, for the necessity of facilitating the deposition of these vapours causes the adoption of a form of apparatus in which, while the cooling action is going on, every facility shall be offered to the condensable vapours for frictional contact against a sufficient internal surface area, by which they shall be deposited, not only in the proportion due to the diminished vapour-carrying power of the gas by its reduction in temperature, but shall also be arrested in advance by purely mechanical friction, in accordance with a well-understood principle, in order that there shall be as little of these vapours as possible left for deposition by the effect of the further cooling of the gas in the subsequent apparatus for washing or for purification. In the frictional contact between the condensed matters and the crude gas which passes over them, we also find the cause of the chemical action of a condenser. For the crude product contains many gaseous ingredients, such as carbonic acid, ammonia, sulphuretted hydrogen, and others of less prominence, which possess, either independently or in chemical union, a greater affinity for the condensed fluids than for the gas which is the required commercial article, and consequently these impurities, or a certain proportion of them, are removed by the fluids, the actual effect being proportionate to the duration and the degree of contact which is secured by the apparatus.

It will be observed that the element of friction is of great importance in the proper conduct of the condensing process, as upon it everything, except the strictly thermal action, in a great measure depends.

Obviously, then, we should endeavour to profit as much as possible by it, and this we can easily do to any extent, subject to the consideration that as friction means pressure, and that again is directly related to velocity, when dealing with the motion of gases or fluids in pipes, we must be governed in the first place by the velocity which in any given case we can allow to the flow of gas through the apparatus. This single datum once determined, the thermal effect alone remains to be calculated.

For example, it may fairly be assumed that in small gas-works, where the connections do not exceed 10 inches in diameter, it will be inadvisable to allow a greater velocity for the gas than say 5 feet per second, and this being taken for granted in the case of works producing 5000 cubic feet per hour in winter, we shall have to find the corresponding size of main by a very simple formula.

(Ex. 2.) $\frac{5000 \times 144}{5 \times 3600} = 40$ square inches area. The nearest diameter to this is 7 inches, which will, therefore, be that of the pipe required.

Now, supposing we wish to employ for these works the simplest and, where convenient, the best kind of condenser—viz., an ordinary gas-main ranged along a wall with just sufficient fall from the horizontal to carry along with it the deposited fluids. And also assuming that the crude gas enters the condenser at a temperature of 120° Fahr., and is to be cooled to 60° Fahr. before it is to be allowed to depart. The temperature of the air and of exposed objects, walls, &c., is 40° Fahr, which is the average winter temperature of the United Kingdom, and we will assume that the entire length of the condenser will be fairly exposed to the air at this average temperature, without disturbance from any neighbouring objects at a warmer point—a condition which should always be preserved in practice if possible. We have already fixed the diameter of the pipe, and we, therefore, have to find the area, and consequently the length of such a pipe, which will be necessary to cool 5000 cubic feet of crude gas per hour from 120° to 60°.

The mean temperature of the gas will be $\frac{120° + 60°}{2} = 90°$.

Referring to the introductory remarks on the subject of thermal science, it will be there found stated that the calculation for the amount of work done in cooling any body is similar to that for heating it through a corresponding range, the only difference being the obvious one—that in one case there is a certain abstraction of heat units, and in the other an increment of precisely equal value; and this value was also shown (see Ex. 1) to be obtained by multiplying together the *weight* of the body in pounds, the *range* of temperature through which the thermal change takes place, and the *constant* representing the specific heat of the body. Therefore, in the present instance, we must first ascertain the actual weight of the gas to be treated per hour, and then its specific heat. From the nature of the body, these two quantities must necessarily be but approximations; the specific gravity of crude gas undergoing the process of condensation being at present matter for conjecture, especially as it varies for every sample of coal carbonized; but taking the average specific gravity of purified gas to be ·42, air being 1·00, we may safely assume unpurified gas to be about ·50, the increase being attributable to the heavy gases it contains. The gas in the condenser being taken as subjected to no pressure, and, consequently, being at its normal density according to temperature, the weight of a cubic foot at the mean temperature of 90° would be ·036 lb., and the weight of 5000 cubic feet would be $5000 \times ·036 = 180$ lbs.

Next comes the determination of the specific heat of the same gas. That of hydrogen is, by Table I., 3·4046; but in this case we have a mixture consisting of about 50 per cent. of hydrogen, and an ever-varying proportion of other gases, whose average specific heat is shown to be much less. We can, however, arrive at a quantity which will express this value with sufficient exactness for ordinary purposes by analogy.

If a gaseous mixture be composed of two or more ingredients in known proportions, and possessing differing capacities for heat, the common co-efficient of the mixture will be the proportionate mean of the whole. And in this case the common co-efficient or constant will be about 2·6. I shall, therefore, throughout the examples which are given in this paper, make use of these two approximate values for the specific gravity and specific heat of crude gas.

Returning to the problem, we shall find that the gas with an initial temperature of 120° is reduced to 60° at the outlet, thus losing 60°; and 5000 cubic feet, weighing 180 lbs., with a specific heat of 2·6, we shall have $180 \times 60 \times 2·6 = 28{,}080$ units of heat to be dissipated per hour. This thermal effect must be produced in the present instance by the cooling action of a horizontal 7-inch pipe exposed to air at 40°.

Bodies internally heated are exposed to cooling influences of three distinct kinds—viz., (*a*) radiation; (*b*) contact of cold air; and (*c*) conduction. In the case of a pipe suspended in the air by small and few supports, the loss by the last-named means will be so insignificant that, for the sake of simplicity, it may be disregarded, and we shall proceed to determine the effect of the two first causes only.

The loss of heat by radiation in air is not affected by the form of the body, but is dependent upon the nature of the substance and surface of the body, and the formula by which its amount is to be ascertained is—

$$R = C \times (T - A) \times P;$$

in which

R = the loss by radiation in units per square foot of exposed surface per hour.
C = the constant representing the diffusive power of the substance or surface of the body.
T = the temperature of the body.
A = the temperature of the air and surrounding objects.
P = the ratio of radiation corresponding to the difference between T and A.

The following table gives the value of C for various materials and surfaces commonly met with in gas condensers (Péclet):—

TABLE II.

	Value of C.
Sheet iron (new)	·0920
Wrought iron (ordinary)	·5662
Cast iron (new)	·6480
Cast or sheet iron (rusted)	·6868
Oil paint	·7583
Lamp-black	·8196

And the value of P for ordinary differences between T and A is as follows (Dulong):—

TABLE III.

Difference between T and A in degrees Fahr.	Temperature of A in degrees Fahr. 32	50	59	68
	Value of P.			
18	·997	1·075	1·120	1·165
36	1·032	1·083	1·160	1·206
54	1·071	1·155	1·200	1·251
72	1·115	1·202	1·250	1·302

The loss of heat by contact of cold air, which must now be dealt with, is independent of the *nature* of the substance exposed, but is entirely dependent on its *form and position*.

For horizontal cylinders, the formula for finding its value is—

$$L = \left(·421 + \frac{·307}{R}\right) \times (T - A) \times P^1;$$

in which

L = the loss in units per square foot of the exposed surface per hour.
R = the radius of the cylinder in inches.
T − A = the difference of temperature between the body and the air.
P = the constant, representing the ratio of dissipation for the difference between the temperature of the body and that of the air, or the value of T − A.

The value of P^1 for ordinary differences is shown by the following table:—

TABLE IV.

Difference.	Value of P^1.
18°	·94
36°	1·11
54°	1·22
72°	1·305
90°	1·372

Before proceeding to the application of these formulæ, it must be borne in mind that the *outside* radius of the gas-main must always be taken, as for good conductors, such as iron, the temperature of the exterior surface is practically the same as that of the interior, especially where cast iron is the material. The comparatively unusual thickness of 1 inch causes a difference of not quite 1° between the internal and external surfaces, so that with pipes of the ordinary thickness of half an inch, or five-eighths of an inch, the difference is practically *nil*.

We may now proceed to combine the two formulæ for radiation and contact of cold air, and so avoid the trouble of separate calculations, thus: Let U represent the totalloss of heat in units per square foot of exposed surface per hour, we shall have

$$U = [C \times (T - A) \times P] + \left[\left(\cdot421 + \frac{\cdot307}{R}\right) \times (T - A) \times P^1\right]$$

In the present problem.

C = cast iron well painted = ·7583. (Table II.)

$T - A = 90° - 40° = 50°$.

$P = 1·1$; $P^1 = 1·2$; $R = 4$.

Then substituting these values—

$$U = [\cdot7583 \times 50 \times 1·1] + \left[\left(\cdot421 + \frac{\cdot307}{4}\right) \times 50 \times 1·2\right]$$

Working out the formula, we have 71·526 units per hour lost from every square foot of the 7-inch pipe of which the condenser is composed. Therefore, to diffuse the previously ascertained total of 28,080 units due to the quantity of gas passing through it per hour, an area of $\frac{28,080}{71·5745} = 392·3$ square feet, and the circumference of a 7-inch pipe being 2·1 feet, a total length of $\frac{392·3}{2·1} = 186$ feet 7 inches will be required.

Having explained in the foregoing example the whole theory, and set out every step of the calculations for a small and simple condenser in detail, we will now take another and larger example of similar type, in order that the working of the same formulæ may be seen divested of all merely explanatory particulars.

(Ex. 3.) Required the dimensions of a horizontal pipe condenser, capable of passing 50,000 cubic feet per hour with a velocity of 10 feet per second; all conditions being similar to the previous example.

For the pipe we now have $\frac{50,000 \times 144}{10 \times 3600} = 200$ inches area, or 16 inches diameter nearly.

Then $50,000 \times \cdot036 = 1800$ lbs. weight of gas, and, therefore, $1800 \times 60 \times 2·6 = 280,800$ units of heat per hour to be abstracted from it. For the loss by radiation, we shall have the same value as before; but the loss by contact of cold air being affected by the size of the pipe, the formula will now be

$$[\cdot7583 \times 50 \times 1·1] + \left[\left(\cdot421 + \frac{\cdot307}{8·5}\right) \times 50 \times 1·2\right]$$

$= 69·1265$ units dissipated per hour for every square foot of the 16-inch pipe; consequently, $\frac{280,800}{69·1265} = 4062$ square feet, and the circumference of a 16-inch pipe being 4·45 feet, the total length of pipe required will be $\frac{4062}{4·45} = 912$ feet 9 inches.

The great length of pipe which is required for plain atmospheric pipe condensers is frequently very inconvenient, and a more active arrangement is often preferred, especially in large gas-works. A common type of apparatus offering this advantage is that known as the annular condenser, the general characteristic of which is the arrangement of two vertical pipes, one inside the other, the annular space between them containing gas which is thus exposed to air on the exterior of the larger pipe and the interior of the inner one, which is to that intent left open for a current of air to pass through it, as in a chimney.

(Ex. 4.) Supposing that the 50,000 cubic feet of gas per hour of the last example are to be treated for condensation in two ways, which is frequently the case in practice, and that the gas is to be first reduced from 120° to 100° in a horizontal pipe, and then finally cooled to 60° in a vertical annular condenser, with an equal area of gas channel.

Here, primarily, gas at a mean temperature of $\frac{120° + 100°}{2} = 110°$ weighing $50,000 \times \cdot035 = 1750$ lbs., loses $120° - 100° = 20°$, and, consequently, $1750 \times 20 \times 2·6 = 91,000$ units of heat per hour. The value of P now equals 1·2, and $P^1 = 1·3$; hence, by the formula previously used $(\cdot7583 \times 70 \times 1·2) + (\cdot4571 \times 70 \times 1·3) = 105·292$; wherefore, $\frac{91,000}{105·292} = 864$ feet area, and $\frac{864}{4·45} = 194$ feet 2 inches lineal of the 16-inch pipe, will be required for this first stage of the operation.

In dealing with the vertical annular pipe, which is intended to complete the process, it must be borne in mind that, all other things being equal, the cooling effect of a vertical surface is less than that of a horizontal cylinder. The reason is that in a calm atmosphere, the air which is in contact with the lower portion of the vertical surface becomes rarified by the heat which it thereby acquires, and ascends, enveloping the upper portion of the body in a medium warmer than the air generally. In practice, however, it may safely be admitted that there is generally sufficient wind to dissipate the greater part of this rarified air; but the theoretical fact remains, and is sometimes very palpably manifested when a close row or cluster of pipes is placed in a confined situation. For the present, it will be making sufficient allowance for this disturbing element if we neglect the values of P and P^1, and thus treat the ratio of diffusion as being simply identical with the difference of temperature between the pipe and the air.

(Ex. 5.) We have now to diffuse $100° - 60° = 40°$ of heat from 50,000 cubic feet of gas at a mean temperature of $\frac{100° + 60°}{2} = 80°$, and weighing $50,000 \times \cdot0367 = 1835$ lbs., consequently offering for diffusion $1835 \times 40 \times 2·6 = 190,840$ units of heat. Further, we find that an annular pipe, or rather pipes, 25 inches diameter outside and 18 inches diameter inside, will fulfil the condition as to area, and the formula will, therefore, be for the outside

$$(\cdot7583 \times 40) + \left[\left(421 + \frac{\cdot307}{12·5}\right) \times 40\right] = 48·13$$

and for the inside

$$(\cdot7583 \times 40) + \left[\left(\cdot421 + \frac{\cdot307}{9}\right) \times 40\right] = 48·53$$

the mean of both surfaces being, therefore, $\frac{48·13 + 48·53}{2} = 48·33$; and, consequently, a total area of $\frac{190,840}{48\ 33} = 3948$ square feet is required; and, the superficies of the annular pipe being 11·25 feet per lineal foot, the required length of such pipe will be 351 feet. This calculation takes no account of the ends of the pipes, and the effect of diagonal connecting-pipes, if any, would have to be calculated separately in the same manner as other cylindrical pipes.

An inspection of the results of the last example, and comparison of the areas found necessary for the first and second stages of the condensation point to another desirable modification of the apparatus. We find that, whereas the gas can be cooled from 120° to 100° by a plain cylindrical pipe, having an exposed area of 864 square feet, a superficies of 3948 square feet is required to cool it from 100° to 60°, although the actual thermometric range is only twice the extent.

This is because cooling in air goes on very slowly, as the temperatures of the exposed body and of the air approach equality; and, therefore, when the difference becomes small, the area of condenser required is out of all economic proportion to the work it is enabled to perform. To prevent this waste of material, the use of water as a cooling agent is very convenient, especially as its action can be easily controlled in order to meet the requirements of a constantly varying production of gas.

The experiments of Péclet have demonstrated that the relative powers of air and water for cooling purposes are as follows:—

TABLE V.

Difference, or T — A.	Total Loss. In Air.	In Water.
10°	8	88
20°	18	266
30°	29	5,353
40°	40	8,944
50°	53	13,437

To show the value of this relative action by an example (Ex. 6). Suppose the final condensation from 100° to 60°, as in the preceding problem, is to be effected in water at the same temperature (40°) as the atmosphere. We had in Ex. 3 a total area of 4062 square feet of 16-inch pipe to do the whole of the work in air, and in Ex. 4 we found that the first stage, or reduction from 120° to 100°, would require 864 square feet of it; hence $4062 - 864 = 3198$ square feet would be the remaining portion. Now, by Table V. we find the proportionate dissipation for the two media for the mean difference of 40°, as in this case, may be taken as 40 to 8944. Therefore $\frac{3198 \times 40}{8944} = 14·3$ square feet, or $\frac{14·3}{4·45} = 3·21$ feet lineal, would be sufficient when immersed in water.

This is the theoretical result, but in practice it would be difficult to provide water in such quantity that it should not be raised in temperature by the heat abstracted from the gas, which condition is necessarily assumed in the calculation. Neither would it be desirable to condense the gas so suddenly, and therefore we must so arrange the apparatus that a certain quantity of water shall flow in contact with the pipe in a direction contrary to that of the gas itself, so that the cold water shall first exert its action on the coolest gas, and, becoming warmed in its course, finally leave the gas when it has attained a certain temperature, which will, of course, be lower than that of the gas at the same point.

Let us suppose that the water may be permitted to depart at 90°, and that the gas-main, at a mean temperature of 80°, as before, is totally immersed in this water, having a mean temperature of $\frac{90° - 40°}{2} = 25°$. If it were in air we should have $(\cdot7583 \times 15 \times 1·16) + (\cdot4571 \times 15) = 20·05$ units dissipated per square foot per hour; and, therefore, the proportion between air and water for this difference being as 15 to 160 nearly (Table V.), we have $\frac{20·05 \times 160}{15}$

= 213·86 units lost in water; and therefore, having 190,840 units to dissipate (Ex. 5), we have $\frac{190,840}{213·86} = 892$ square feet, or $\frac{892}{4·45} = 200$ feet, as the total length to be immersed in the water.

(Ex. 7.) We can now calculate the actual quantity of water which will be required for the work of condensation, according to this example. The water is raised from 40° to 90°, or an increase of 50°, and there will consequently be required (Ex. 1) $\frac{190,840}{50} = 3816·8$ lbs., or 381·68 gallons, per hour.

We are now in a position to extract from the preceding examples a net formula for expressing, in the most compact form, the rule for finding the area of any condenser.

Let X = the area required; then

$$\frac{W \times L \times S}{U} = X;$$

in which

W = the weight of gas (corrected to its mean temperature) to be condensed per hour.
L = the total reduction of temperature in degrees Fahr.
S = the specific heat of the gas.
U = the dissipating power of the condenser per square foot (see formula for finding U).

Annular water condensers are sometimes used, in which the inner pipe is filled with water, while the outer surface is exposed to the atmosphere. In such cases, the total effect produced may be easily calculated by combining the formulæ for air and water already given.

The types of condensing apparatus, known as dry scrubbers, battery condensers, and the effect due to the action of an evaporating spray of water on the surface of any form of condenser, are not treated of in this paper, because they are subject to so many disturbing influences that any attempt to apply the usual formulæ to them would be more likely to mislead than to assist an inquirer.

The material of which all the apparatus herein described are presumed to have been constructed is cast iron, thoroughly painted. Table III. shows the comparative radiating power of various substances. Péclet also found that the actual loss of heat by a sheet-iron flue-pipe was less than that of a cast-iron pipe of equal thickness, in the proportion of 1 to 3·35. We should consequently bear in mind, when considering the advantages derivable from the substitution of wrought for cast iron, as the material for pipes of large dimensions, on the grounds of lightness and economy, that this proportionate thickness must be observed in order to secure an equal effect. Setting aside the question of cost, there is nothing to be gained by using thin cast-iron pipes instead of those of the ordinary, or even excessive, thickness, as I have mentioned when explaining the formula for cooling by contact of cold air; in fact, the cooling effect of a cast-iron or copper pipe of reasonable thickness is greatly in excess of that of a similarly constructed pipe infinitely thin.

The difference in the amount of radiation between a whitened and a blackened pipe is about 10 per cent. in favour of the latter, but against this must be set the correspondingly superior power of the blackened surface in absorbing heat-rays from the sun.

Too much stress cannot be laid on the importance of keeping condensers freely exposed to the true average atmospheric temperature, and preventing, as far as possible, all disturbance from the proximity of artificially heated bodies, and particularly guarding against too close stacks or tiers of pipes in the condenser itself, all of which evil influences will seriously impair the efficiency of the apparatus. Where any such are present, the power of the condenser must be increased if other means of surmounting the difficulty are unattainable.

The chief objection to any fixed rule for the proportions of a condenser will also apply to almost every other apparatus for use in gas-works, and is based on the difficulty of restraining to formal dimensions a structure which, if designed with a view to immediate necessities, will, by the natural increase of the majority of such undertakings, become utterly disproportionate in a very few years; while if the future is exclusively regarded, there will be an excess of power in the present—so that there appears to be only a choice of evils, for too much condensation is as bad as, or worse than, not enough. This is an apparently insurmountable obstacle in the path of absolute scientific accuracy, and may lend strength to the plea for the rule-of-thumb practice in such matters, by making it appear that as any fixed apparatus will always be more or less wrong, it will be useless to take any trouble in the direction of deducing a rule, however exact, so long as it must be based on some starting-point which can never be maintained throughout the period during which the apparatus will probably be used.

The answer to this argument is that it is precisely that consideration—viz., the ever-varying amount of duty expected of this apparatus, and the disturbing influences to which it may be subjected, of which the usual hap-hazard rules take no account; but that if an absolute formula, based on strict scientific reasons, be adopted for a certain assumed duty under known conditions, the amount of divergence from those conditions in any special case may be allowed for, and the ultimate result to be obtained in this method will be nearer the truth than any crude approximation based on the observation of effects possibly produced under very different circumstances. Suppose, for example, certain gas-works double their production in ten years. The correct mode of procedure for determining the size of a condenser for such works would be to apply the formulæ for the estimated production five years hence, the activity of the apparatus could be reduced for the present by enclosing or sheltering a portion of it, and when that point becomes exceeded, it may be heightened in effect by a water spray or other means, until permanently enlarged or supplemented. Or if water be permanently utilized, in the manner explained in Ex. 6, a more or less rapid flow could be made to regulate the power to any required extent.

But, in the absence of any such reliable rule, it is impossible to decide between such different *dicta* as are quoted in the early part of this paper, or to understand whether apparatus designed in accordance with either proportion would be correct for present or prospective use.

The old maxim, that thorough condensation is half the purification, contains a considerable amount of truth, but must be accepted with the qualification that while the condensation should certainly be so complete that no unnecessary tarry or aqueous matters should be carried forward by the gas, to be deposited in the scrubbers or purifiers, it should not be so excessively "thorough" as to rob the gas of its illuminating power.

It is the undeniable importance of the subject which has led to this attempt at the application of those abstract principles, whose truth has been proved by careful experimental research on the part of those writers, to whom reference has been made in the course of this paper, on the present particular question. No pretence is herein made to the final settlement of the matter; but it is hoped that the formulæ set forth may be applied to, and tested by, the light of careful practical observation by those who are best competent to speak with authority on this and kindred subjects, in order that future practice may be firmly settled on some more intelligible and uniform basis than has been apparent hitherto.

Correspondence.

[*We do not hold ourselves responsible for the opinions expressed by Correspondents.*]

SEWAGE GAS.

Sir,—Referring to your issue of the 18th of June, p. 947, will your correspondent, Mr. Thomas A. Collinge, state how the sewage sludge was reduced to only 9·14 per cent. of moisture, as this seems to me the greatest difficulty to be overcome in dealing with such material?

Chester, June 27, 1878. JAMES HELLYAR.

Sir,—In your issue of the 18th inst., I read with great interest of the manufacture of gas from dried sewage sludge, in which your correspondent, Mr. Thomas A. Collinge, states that a portion could be carburetted and used on the works for illuminating purposes. Will that gentleman, holding such an important position as he does, give us his assurance that good illuminating gas can be produced, and at what expense per 1000 cubic feet, as this method of treating a waste product might become valuable, if the cost was not too great?

Manchester, June 26, 1878. C. R. N.

LEAKAGE.

Sir,—May not the loss of gas by leakage, sustained by the Gas Companies, be explained as follows?

The gas supplied to the consumers by the Gas Companies is composed of two free gases—the carbon, a heavy gas, and the hydrogen, about the lightest gas known. The latter may separate itself from the former and filtrate through the cast-iron main-pipes, leaving neither smell nor discoloration of the surrounding soil. The carbon compound, being too dense to penetrate through the same pipes, remains behind, unless there is a fissure sufficiently large to admit of its escape, in which case the odour and discoloration of the adjacent soil is the evidence.

Perhaps one of your readers would undertake to prove the truth or fallacy of the above supposition.

June 26, 1878. T. F.

Parliamentary Intelligence.

HOUSE OF LORDS.

MONDAY, JUNE 24.

Drumcondra, Clonliffe, and Glasnevin Township Bill, East Retford Borough Bill,—reported with amendments.

Radcliffe and Pilkington Gas Bill,—referred to a Select Committee, consisting of Earl Camperdown (Chairman), Lord Forbes, Lord Gage, Lord de Mauley, and Lord Lyveden; to meet on Wednesday, June 26.

TUESDAY, JUNE 25.

Leicester Corporation Bill.—Commons amendments considered, and agreed to.

Public Health (Ireland) Bill,—brought from the Commons, and read the first time.

Weston-super-Mare Improvement Commissioners Bill,—reported with an amendment.

Grand Junction Water Bill,—read the third time, and passed.

Maryport Improvement Bill,—read the third time, with the amendments, and passed.

Cheltenham Corporation Water Bill.—Report read from the Select Committee, that they had not proceeded with the consideration of the Bill, the opposition thereto having been withdrawn.

PUBLIC HEALTH ACT (1875) AMENDMENT BILL.

On the motion for the third reading of this Bill,

Earl DE LA WARR moved that it be read the third time that day six months. He said he felt that he owed to the House a few words in explanation of the course which he had adopted with regard to the Bill. When it was under discussion on the second reading, he asked their lordships to refer it to a Select Committee, but he did not take the opinion of the House, hoping, as he then did, that amendments would be proposed which would remove the objections which were urged against the measure. This, however, had not been the case, with the exception of one proposed by the Duke of Somerset, and, though slightly modified, the principle of the Bill had not been changed. He therefore asked their lordships, at this stage of it, not to pass the Bill. He should not trespass on the time of the House by recapitulating the arguments which had been used against the measure. He might, perhaps, mention what was stated by the Marquis of Salisbury, that if passed into a law it might increase already existing difficulties as regarded providing suitable cottages in cases where they were much required. Also, he might refer to

what was mentioned on the second reading by Earl Cowper—that the Bill would place power in the hands of Local Authorities who were not competent to exercise it; and this really touched, as it seemed to him, the objectionable principle of the Bill. There would be a power of interference with cottage property given to small Local Authorities—a power which required very great judgment and discretion in the exercise of it, and this they could hardly expect to find among a not very highly educated class; and not only would that power extend to existing cottages, but it went so far as to make it necessary to obtain the consent of the Rural Sanitary Authorities before a cottage could be built. It might so happen that it was absolutely necessary that a cottage should be built in an agricultural district distant from a town or village, but the Rural Sanitary Authority would have the power of objecting if there was not, in their view, a sufficient supply of water. Now, was it desirable to put additional difficulty in the way of cottage building? Surely it was to the interest of a landowner that the cottages on his estate should have a good, wholesome supply of water. There might be difficulties at times, and there might be exceptional cases, but it must be the interest of every owner of cottages as far as possible to overcome the difficulty, and, moreover, as the law now was, if the water was impure and unfit for drinking, as was too frequently the case in towns and villages, there was sufficient power to enable the Sanitary Authority to interfere. It seemed to him there was also the very great objection to the Bill, that it was dealing with a large and important question in a piecemeal manner. It was found most inconvenient to have numerous disconnected Acts upon a great question like the sanitary one of almost daily recurrence, and he believed he was right in saying that the consolidation of sanitary Acts had been recommended by a Commission. For that reason, also, he thought it would be better to defer the settlement of this question, which he could not believe was a very pressing one, till it could be more fully and generally considered in its bearing upon, and in its connection with, other sanitary Acts which it might soon be proposed to consolidate.

The Earl of KIMBERLEY hoped their lordships would reject the amendment. The Bill was within very narrow limits. The gist of it was that where a supply of wholesome water could be supplied at a moderate cost, the maximum of which was defined by the Bill, it should be supplied by the owners of cottages. There was ample protection for owners in the way of appeal to the Local Government Board, and where owners of cottages thought that water-works should be constructed at the cost of the whole of the rural community, they could apply to the Local Government Board for the construction of such works. He thought a great deal of the alarm which had been felt about the Bill was unfounded. It sought that where a supply of wholesome water could be provided to any cottage for £8 13s. 4d. it should be provided, and he thought it was quite clear, if a supply could be provided for that sum, that no great hardship would be imposed upon owners. On the other hand, there was a protection to owners, in certain of the provisions, against anything like an undue expenditure where it was not practicable to provide a water supply within the limits of £8 13s. 4d. per house. A gentleman, who had paid great attention to this subject, had written to him urging as an objection to the Bill that it would prevent the construction of water-works in many parishes. He hoped it would have such an effect, because he thought that, in parishes where the water wanted for particular cottages could easily and cheaply be supplied by the owners of those cottages, it would be an evil to put the whole community to the cost of constructing water-works which were not generally required. The noble earl who had moved the amendment seemed to think that the Bill conferred some very novel authority upon Sanitary Inspectors and Rural Sanitary Authorities. That was a mistake. At present they had the power of condemning a water supply and prohibiting its use. The Bill only conferred on them the additional power of providing a supply of wholesome water. They had not that power now, even in cases where they deprived cottages of the only supply of water they had, by condemning and prohibiting its use. He submitted that there was no reason to suppose that the measure would in any way work oppressively; on the contrary, it was one which might very safely and usefully be passed into law.

The amendment was negatived without a division, and the Bill was read the third time, and passed.

THURSDAY, JUNE 28.

Lichfield Gas Bill, Trowbridge Water Bill.—Commons amendments considered, and agreed to.

Radcliffe and Pilkington Gas Bill,—Report from the Select Committee read, that they had not proceeded with the consideration of the Bill, having found that the petitioners had no *locus standi* before them.

Drumcondra, Clonliffe, and Glasnevin Township Bill, East Retford Borough Bill, Limerick Corporation Gas Bill,—read the third time, with the amendments, and passed.

HOUSE OF COMMONS.

MONDAY, JUNE 24.

Bradford Water and Improvement Bill.—Lords amendments agreed to.

Leicester Corporation Bill (Lords),—read the third time and passed, with amendments.

Public Health (Ireland) Bill,—read the third time, and passed.

TUESDAY, JUNE 25.

Lichfield Gas Bill (Lords), Trowbridge Water Bill (Lords),—read the third time and passed, with amendments.

Mansfield Commissioners Gas Bill (Lords),—read a second time, and committed.

Exeter Gas, Normanton Gas, Sutton-in-Ashfield Gas Bills (Lords),—reported with amendments.

The petitions were withdrawn of Charles Wheler Wheler against the Castleford and Whitwood Gas Bill (Lords), and of John Alexander Sinclair MacLagan against the Forfar Water Bill (Lords).

WEDNESDAY, JUNE 26.

Hamilton Burgh Bill.—Lords amendments agreed to.

A petition against the Castleford and Whitwood Gas Bill (Lords) (the petitioners not praying to be heard) was presented from the Castleford District Local Board of Health.

The petition of the Corporation of Warrington against the Warrington Water Bill (Lords) was withdrawn.

FRIDAY, JUNE 28.

Warrington Water Bill (Lords)—reported, with amendments.

Cardiff Water Bill.—Lords amendments agreed to.

HOUSE OF LORDS COMMITTEE.

WEDNESDAY, JUNE 26.

(*Before Earl* CAMPERDOWN, *Chairman; Lord* FORBES, *Lord* GAGE, *Lord* DE MAULEY, *and Lord* LYVEDEN.)

RADCLIFFE AND PILKINGTON GAS BILL.

Mr. POPE, Q.C., appeared for the promoters; and Mr. MICHAEL, Q.C., represented the Local Boards of Little Lever, Prestwich, Radcliffe, and Whitefield, who had petitioned against the Bill.

Mr. POPE, in opening the case, said it was proposed by the terms of this Bill to raise an additional capital of £130,000 by auction sales, with the exception of £40,000 which was to be taken up by the original proprietors. This money was to be expended in the construction of new works. It was opposed by certain Local Boards within the district supplied by the Company, but the Referees of the House of Commons had held that they had no *locus standi*, as this was purely a money Bill. He trusted their lordships would adopt the same view as that held by the other House.

Mr. MICHAEL claimed for the Local Boards which he represented the right to be heard in opposition, as his clients were the lighting authorties and the representatives of the ratepayers of the district. The 26th clause, relating to the pressure of gas, was an entirely new one, and, as it was alleged that several mills had been compelled to close earlier than they would otherwise have done in consequence of the deficient supply, he thought he should be allowed to call evidence on that point.

Mr. POPE remarked if that was the only opposition his friend had to the Bill, he should have no objection to meet him on the point, as the clause was only a renewal of one inserted in a former Act.

Mr. MICHAEL replied that this alteration was so important that in itself it entitled him to be heard on the merits of the Bill. When the Bill came before the Referees, nothing was said of the way in which the £130,000 was to be raised, but, in accordance with the terms of Standing Order No. 140, the Referees had power to insert the auction clauses, and they were bound to do so unless they furnished their reasons why they did not think proper to do so. Now, out of this sum £40,000 was to be taken up by the original Shareholders, a circumstance which would prevent a large sum being devoted to the benefit of the consumers. If the whole of the £130,000 had been put up to auction it would represent a difference in the cost of production of 2 per cent. If, then, he was able to show that this Bill made material alterations in the supply of gas, and also altered the price of gas, he would submit that he had established a very powerful reason why the Local Authorities of the district, as representatives of the ratepayers and also of the consumers, had a right to be heard, and more especially so as he could further establish that the present Company were unworthy to carry on the establishment they now had.

Mr. POPE submitted that the petitioners were not the representatives of the consumers, but simply of the ratepayers, and that it was really because other interests were represented that the Bill was opposed. The reason why the Local Boards wanted to purchase the Gas Company was in the interest of the ratepayers, so as to make a profit out of the sale of gas. With regard to clause 10, it was true that the auction clauses were inserted, but only to the extent of £90,000, the Committee, in accordance with the terms of the Standing Order, assigning their reasons why £40,000 should be allotted to the original Shareholders. So far as clause 26 was concerned, with respect to the amount of pressure, that surely did not give them a right to come to the Committee and oppose the whole of the Bill on its merits. The whole object of this clause was to carry out the Act of 1871. But if Mr. Michael wanted to discuss that clause only he had no objection to his being heard. His friend had, however, a far wider object in view, and that was to be heard on the merits of the Bill itself, a proceeding which would be irregular, as the Referees had already decided that the petitioners had no *locus standi*.

The room was then cleared, and, on the public beng re-admitted,

The CHAIRMAN said: The Committee are of opinion that the petitioners have no *locus standi*.

The Bill was then referred to the Committee on Unopposed Bills.

HOUSE OF COMMONS COMMITTEE.

MONDAY, JUNE 24.

(*Before Mr.* STANSFIELD, *Chairman; Mr.* SIMONDS, *Mr.* WETHERED, *and Mr.* SWANSTON.)

EXETER GAS BILL.

Mr. POPE, Q.C., Mr. MICHAEL, Q.C., and Mr. PITT LEWIS appeared for the promoters, the Exeter Gaslight and Coke Company; Mr. GRANVILLE SOMERSET, Q.C., and Mr. BALFOUR-BROWNE for the petitioners, the Corporation of the City of Exeter.

Mr. POPE, in opening the case for the promoters, said the object of the Bill was to empower the Company to acquire further lands for the extension of their works, to raise additional capital, and for other purposes. Their present Act was dated 1865, but the original incorporation of the Company was in 1816. The works had been carried on with great economy, so that, in fact, at present, they were not of such a character as was required for the supply of so important a community as that of Exeter, and it was necessary to obtain capital to enable the Company to carry out extensive alterations. Between 1836, when an Act had been obtained, and 1865, various attempts had been made to promote other Companies; and by the Exeter Gas Act of 1865 a new Company was incorporated, in whom was vested the whole of the property of the two Gas Companies then existing in Exeter, the capital of the new Company being £40,000 original stock, and £10,000 4 per cent. preference stock; the Company being authorized to raise a further capital of £20,000 preferential 5 per cent. shares, as well as to borrow £7500 on mortgage. The whole of this capital had been raised and laid out on the undertaking of the Company, and now, the demand for gas having increased, and continuing to increase, the Company came to Parliament for powers to raise additional capital, and to acquire further lands in order to extend their works. They proposed to raise £100,000 additional capital, by the issue of new shares, limiting the issue to £40,000 in the first year, and £20,000 in each succeeding year till all had been raised. The new capital was not to pay more than 7 per cent. dividend, while such as might be issued as preference shares not more than 6 per cent. The Company proposed to afford the public every guarantee, for they had adopted the auction clauses, and before the offering of the shares, four weeks notice was to be given, while any premium obtained on the shares was to be applied to the extension of the works, and not to be considered as capital. The sliding scale was also adopted, so that for every penny charged for gas beyond the standard price, the dividend was to be reduced a quarter per cent. Power was also given to borrow on mortgage to the extent of one-quarter of the new capital raised; but this borrowed money could not be converted into capital bearing a higher dividend than 5½ per cent. per annum. The quality of the gas to be supplied was to be equal to 14 candles, and the Company undertook to supply it under a proper pressure, and under fair conditions as to testing by a Gas Examiner. In the Bill, as was presented, it was sought to raise an additional capital of £130,000 and £32,000 loan, being a total of £162,000; but in the House of Lords, after a discussion of this question, the capital was reduced to £100,000, or £125,000 in all. Had it not been for the necessity for the acquisition of more land, the Corporation would not have been allowed to oppose the Bill, for the mere question of the increase of capital would not give them such power; and he believed that there was not much difference of opinion as to the necessity for the additional capital. The real ground of the opposition seemed to be that which often arose when works were successful—viz., that the Local Authorities wanted to buy the undertaking, but could not make up

their minds to buy it at the moment, and wanted to induce Parliament to compel the Company to sell whenever they could make up their minds to buy. The auction clauses, which were now made imperative in all gas Bills by a Standing Order of the House, removed the principal ground, if not all ground, of objection to the increase of capital on the part of Local Authorities. The petition of the Corporation alleged in paragraph 8 that the large amount of additional capital was excessive, and not required for the Company's business, and that, notwithstanding the protection supposed to be afforded by the auction clauses and sliding scale, embodied in the Bill, if the raising of such new capital was sanctioned, the reduction in the rate for gas, to which the consumers and inhabitants of Exeter would be entitled under the Gas-Works Clauses Act, 1847, would be prevented or postponed. The following paragraph stated, "That the price proposed to be charged for the Company's gas is excessive, and that, inasmuch as the only justification for the maintenance of such a price appears to lie in the fact that by the Exeter Company's Act, 1865, the public lamps are required to be supplied at a price not exceeding 3s. per 1000 cubic feet, your petitioners, who are the owners of the public lamps, are willing to forego their advantage, and to pay for all gas consumed by such lamps at a uniform standard price common to all consumers, provided a reasonable and proper reduction be made in the amount proposed to be fixed as the standard price." But it might be observed that the Corporation had no power to bind other authorities who were equally concerned with themselves, and, moreover, they had not even the power to make such a bargain for themselves. The true meaning of the petition was, as he had already said, that they wanted to be able to buy the works on their own terms. The petition contained allegations as to certain matters connected with the works and the supply of gas, but with regard to such of these as had any foundation, all he need say was that the additional capital for which the Company were applying would enable them totally to remove all ground for complaint. The petition objected to the standard of lighting, but he believed that 14 candles was as high a standard as had been inserted in any Gas Act. The real gist of the petition lay in paragraph 16, which dealt with the question of the sale or transfer of the undertaking. It stated, "That your petitioners believe that a remedy for the evils complained of can only be found in a sale and transfer of the Company's undertaking to your petitioners (as the Sanitary Authority of the district) who are willing to purchase the same, and, having regard to the manner in which the Company have during the last 25 years administered that large and important undertaking, maintaining during this period an excessive price, because through their neglect and mismanagement they wasted nearly £6000 worth of gas a year, and yet supplying an article inferior in quality and insufficient in quantity, and conducting their processes so unskilfully as to cause the utmost annoyance and discomfort to large numbers of the inhabitants, and a serious depreciation in the rateable value of such parts of the city as lie within the influence of their noxious vapours. Your Petitioners submit that the Company's administration has not been such as to warrant Parliament in entrusting them with the large powers proposed to be conferred by this Bill, or to afford an earnest that they would be likely to take a broad and enlightened view of their obligations as a public Company with a parliamentary monopoly, so as to ensure that the contemplated outlay upon the works shall be made to the best advantage, in the interests alike of the consumers and their own Proprietors." The next paragraph referred to an offer which had been made by the Corporation for the purchase of the Company's undertaking. It happened some months ago that there had been an agreement come to between the Company and the Corporation for the purchase of the works, but the Town Council had refused to ratify that agreement, because there were then, as now, some people who believed in the introduction of the electric, or some other visionary system of lighting, and feared the permanency of the gas lighting system. The Company had no such apprehensions; they believed they had a sound and permanent undertaking, which they would be ready to dispose of to the Local Authority for a fair value, and the passing of this Bill could not prejudice the Local Authorities if they wished to purchase. The Act would be as necessary to them as to the promoters, and the auction clauses operated so as to prevent their suffering any injury from the raising of additional capital, inasmuch as any premiums obtained on the capital must go to the extension and improvement of the works without bearing dividends. This paragraph contained a statement which was most irregular, for it set forth an offer which had been made for the purchase of the gas-works, and which had been refused by the Company. This suggested the idea that the offer had, in fact, been made for the purpose of setting it out in the petition, but when the proper time came the Company would be perfectly prepared to give excellent and satisfactory reasons for their non-acceptance of the offer. The best thing that could be done for the Corporation and for the people of Exeter would be to pass this Bill, for the improvements were needed in any case, and must be carried out for the efficiency of the lighting of the town, and if the Corporation chose to purchase they could do so after the Bill had been obtained as well as they could have done previously.

Mr. *Wm. Cuthbertson*, examined by Mr. MICHAEL, said he had been a Director of the Gas Company since 1867, was elected Vice-Chairman in 1871, and Chairman in 1872, which position he still held. He was a member of the Local Board of the parish of St. Thomas, in which the works were situated. A complaint had been made by the Corporatien as to some alleged nuisance arising from the works. The Company had offered every facility for the examination of the works, but the complainants had failed to point out any nuisance. The Company then brought down Dr. Letheby, who examined the works, and who reported that no stench from the Gas Company's works could possibly cross the river. [The report was handed in.] The Corporation then brought down Dr. Redwood, who examined the works for them, and whose report confirmed that of Dr. Letheby.

Mr. MICHAEL asked the Committee to adjourn for half an hour, as it appeared that some negotiations had commenced, which might result in the withdrawal of the opposition.

The CHAIRMAN thought such a proceeding somewhat irregular. The matter had come before the Committee, and he considered that they ought to have carried on the negotiations before coming there.

Mr. MICHAEL said the course was in accordance with the usual practice. If the negotiations did not result in an arrangement, he was ready to go on with the Bill, and fight it out to the end; but it might be an advantage to save the time of the Committee.

The Committee then adjourned for half an hour, and, on the parties again appearing,

Mr. MICHAEL said he was happy to state that an arrangement had been come to, by which the Corporation agreed to purchase the works. He should now, therefore, simply give formal evidence to sustain the preamble.

Mr. *Alfred Penny*, C.E., examined by Mr. MICHAEL, said he was well acquainted with the works of the Exeter Gas Company. The works were much in need of improvement, and, owing to the largely-increased demand for gas, they required considerable extension. He considered the capital sought for by the Bill was as little as should be asked for, considering the steadily-increasing requirements of the city of Exeter. The powers as to the purchase of the land were such as it was only reasonable should be granted.

Cross-examined by Mr. GRANVILLE SOMERSET: He knew that an arrangement had been come to, according to which the Corporation were to purchase the works from the Company. Therefore, as the land belonged principally to the Corporation, there would be little difficulty now as regarded its acquisition.

Mr. SOMERSET said he had no more to ask. The arrangement had been made, and he, therefore, consented to the passing of the Bill, subject to the conditions of purchase.

Mr. MICHAEL asked the Committee to declare the preamble proved.

The Committee passed the preamble, and the clauses having been gone through, the Bill was ordered to be reported to the House.

Miscellaneous News.

MALTA AND MEDITERRANEAN GAS COMPANY, LIMITED.

An Ordinary General Meeting of the Shareholders of this Company was held at the London Offices, 60, Gracechurch Street, E.C., on Tuesday, June 25—J. B. PADDON, Esq., in the chair.

The SECRETARY (Mr. F. A. Duffield) read the notice convening the meeting, and the following report was presented:—

The Directors herewith present to you the audited statement of accounts for the year ending March 31, 1878. Compared with the accounts of last year, there has been an increase in the sale of gas, and a decrease in the amount realized by the sale of residual products.

Provision being made for payment of interest on debentures and dividends on the first and second preference shares, the Directors recommend that from the remaining profits a dividend of 2½ per cent. per annum on the ordinary capital of the Company be declared, free of income-tax, and that the sum of £770 7s. 10d. be carried to reserve-fund.

The Directors regret to announce the death of Mr. E. P. Rowsell, the Secretary of the Company. Under the Articles of Association, the appointment of his successor will have to be made by the Proprietors in general meeting.

The Director retiring by rotation is Mr. J. B. Paddon, who offers himself for re-election.

Dr. *Profit and Loss, for Twelve Months ending March 31, 1878.* Cr.

Coal		£6,347	18	1	Gas	£19,640 8 8
Gas-making (salaries and wages)		2,411	12	11	Coke	2,537 7 8
Charges on street lights		1,199	2	5	Tar	139 12 5
Wear & tear (maintenance)		1,241	10	4	Meters and fittings	69 18 0
Purifying materials		94	15	8	Interest	437 8 1
Rents		42	2	2	Transfer fees	2 17 6
General trade charges		903	0	9		
Bad debts and allowances		99	3	5		
Treasurer's commission at stations, and audit fee at Malta		259	1	0		
London expenses		1,126	4	1		
Law expenses		58	13	5		
Exchange		591	14	11		
Discount		19	10	5		
Income-tax		32	7	5		
Balance to interest and dividend account		8,409	15	4		
		£22,827	12	4		£22,827 12 4

The CHAIRMAN said: The Directors, in the report they have presented, have acquainted the Shareholders with the circumstance of the death of Mr. E. P. Rowsell, the late Secretary of the Company. The Company, and especially the Directors, have experienced a great loss by that gentleman's lamented death. Mr. Rowsell was a man of great natural ability, whilst his uniform amiability made it a pleasure to have the honour of his acquaintance. He had been connected with the Company from its very first year, and his interest in it was paramount. I think that you will, with me, consider that the Company have by his death sustained a loss which cannot be made good. With regard to the accounts, to a casual observer, the points of difference between those for last year and the preceding year would appear unimportant; but though they are slight, they are most interesting with respect to the affairs of the Company. To the careful observer, they speak for themselves; and, therefore, I will not refer to them in detail. If you look to the accounts, you will see a slight change with regard to the capital. They previously contained the sum of £3000, representing the amount expended in placing the ordinary share capital of £75,000. The actual working capital being only £72,000, the £3000 has been placed on the other side of the general balance-sheet as part of the general expenditure. Probably, in course of time, it may be merged in that sum, and disappear altogether, for there cannot be any real use in maintaining it so prominently. Since our last meeting we have had an addition to the capital—a sum of £200 on account of the second preference shares; but, at the same time, we have reduced the debentures £450, so there is some improvement there. As to these debentures, the Directors have never lost sight of the desirability of reducing their amount; but it is evidently a process which must be carried out with caution. The Directors were prepared to cancel a considerable number of these debentures which will fall due on the 1st of next month, but the owners were all, or very nearly all, willing to renew at 5 per cent., and, so long as the Company can issue debentures at 5 per cent., they were scarcely justified in willingly cancelling them. The Directors, therefore, have accepted the offers of renewing at 5 per cent., and the means which we had at our disposal for cancelling these debentures will remain with us, and be carried forward to the time when the next batch of debentures will fall due. It is a fact within easy memory that our debentures were coldly looked on at 7 per cent., and actually declined at 6 per cent., so that the fact that we are able now, at the instance of the holders, to place them at 5 per cent. is a most satisfactory one, and one from which the Directors have derived very great encouragement. On the other side of the balance-sheet you will find that there is an additional expenditure of £1074. Of that about £850 is the amount expended on our new station, Valetta, and about £220 is divided among all our other stations, and in all cases it has been chiefly for the extension of pipes. As to extensions of that kind, we are scarcely free agents. We are under certain obligations in respect to our concessions which must be maintained whether these extensions are profitable or not. We have, however, for some years past had no unprofitable extensions. All the other items in this account, I think, may be taken as they stand, for they do not seem to me to call for any remark. Turning to the profit and loss account, and at the first item contained there—that of coal—we find that we have spent more money in coals than we did last year; but that amount is only in proportion to the larger quantity of gas we have sold. The cost of coal per ton has, of course, been somewhat less. If all the other items under that be added up, you will find that in 1877 it amounted to £8054, while in 1878 the amount is £8070, so that within a very few pounds the accounts are similar. But we have been rather unfortunate in the matter of exchange this year. Had it not been for that, the working accounts this year would have stood in a very favourable condition indeed compared with those of 1877. On the other side you will

find our receipts have been much prejudiced by the decreased value of our residuals. We suffer in common with almost all other Gas Companies in that way, and it is a matter so absolutely beyond our control that we can say nothing about it. But that and all other adverse circumstances are more than compensated for by, to us, a considerable increase in the sale of gas. The increase in our gas-rental has amounted to about 4½ per cent., and if I should seem to be a little too exultant on that point, I may remind you that for the last five years this Company have been either standing still or going back, and therefore when we find ourselves in possession of an increase of 4½ per cent., you may pardon our being a little elated. We do regard it as a very encouraging circumstance indeed. Lower down you will find an unusual item—that of interest—a sum of £437. That interest arises from a debt which was owing to us for many years from the Municipality at Marsala. I have often from this place regretted to the Proprietors that so much money, so large a debt, should remain unpaid, and the Directors used every endeavour to obtain payment of that debt, and last year they were successful. The debt has been paid, and interest thereon has been brought to charge. Altogether, the total outcome of profit and loss account is that a very handsome sum to us of £770 is available for being carried forward to a reserve-fund. On the question of reserve fund, I should like to say a word or two. You will remember at our last meeting that, in order to give 2½ per cent. dividend on our ordinary capital, and make a "clean sweep" of a great many things, and put the accounts generally in a more healthy condition, it was necessary to absorb the reserve-fund, but it was done with considerable reluctance on the part of the Board. The fact is that this Company need a good reserve-fund. It ought to be of a very large amount; and I look forward with pleasure to the time when we shall be able to have a satisfactory one. It is open to any of the proprietors to say, "Why, out out of such a sum, can you not give us another half per cent. dividend?" Well, all I can say is, that all over 2½ per cent. should be put to reserve-fund. I have no doubt that, on a little consideration, the Proprietors will concur with the Directors as to the desirability of re-establishing this reserve-fund. All the reports which we have been receiving from our stations show that the whole are in a satisfactory condition, in good working order, and, in many cases, with considerable surplus power. It is a good thing for us that these works were originally well constructed. I suppose that our wear and tear account is a very moderate one indeed; and yet I believe, so far as we can know, that our works were never in a better condition than at present. Another good thing in connection with our stations is, that the increase does not come from one station, but all have contributed to it—unequally, but all are represented in that increase. For instance, I find that at Valetta we had 4½ per cent. increase; at Calcara, 2½; at Corfu, 9½; at Trapani, 6; and at Marsala, 1 per cent. increase. All these things are very satisfactory; and I ought to mention, with regard to the Sicilian stations, that the Directors have availed themselves of the services of Mr. Simmelkjor, who resides at Cagliari, and believing him to be a very proper person for the purpose and a thoroughly independent man, we requested him to visit, inspect, and report on their Sicilian stations. We have just received that report; but we have received it so recently that we could not take any action on it. We shall do so, however, and that action can hardly fail to be beneficial. I think it may be taken for granted that we meet under somewhat improved circumstances; we have shown some progress. Progress is very necessary to us; and if that progress can only be continued—and I am sure it will be the object of the Directors to make it so—I think that all our reasonable expectations will be gratified. I have now to move—"That the Report of the Directors and Balance-sheet and Accounts be approved and adopted."

Mr. SAMUEL ANDREWS seconded the motion.

Mr. PAUL asked a question as to the interest and dividend account. He saw a sum of £4144 opposite it, but he was in a difficulty on the matter.

The CHAIRMAN said the obscurity arose from this: They ought, under their Articles of Association, to pay dividends annually, but in deference to the wishes of the Proprietors, the dividends on the preference shares were paid every six months. Consequently, the figures were somewhat difficult to understand in that way; but they saw the amount of the account and the rate of interest, and it would not be difficult to find what the annual sums were.

Mr. PAUL also asked, if the £700 were placed to reserve-fund, was all their ready money exhausted? Had they nothing at their bankers, or were they trading on the credit of their bankers? He saw that the debentures were some £40,000 odd, and they were now commencing at the rate of 5 per cent. If he mistook not, a large portion of that sum was bearing 7 per cent. When they renewed them at a lower rate, would they not be able to increase the reserve-fund, or the 2½ per cent.?

The CHAIRMAN said that, as to the working account, they might take it for granted that they would not be much credited by carrying the £770 to reserve, but they would be able to use it as working capital. As to the debentures, there could be no doubt that any reduction of interest they might be able to obtain through their more prosperous circumstances would be a benefit to the Shareholders—it would increase the Company's means, at any rate. In the next report that was printed, they would see the sum of £770 standing as a reserve-fund. Those words would re-appear, and this amount would stand opposite them, and then it would be for them, so far as they could, to add to it as fast as they could.

Mr. W. T. MORRISON desired to supplement the Chairman's observations with respect to their late Secretary. He had had the pleasure of knowing Mr. Rowsell from the very commencement of the Company, and he had found him on every occasion most active and courteous. Every one would concur in the loss sustained by the Company in the death of Mr. Rowsell, and he would suggest whether it would not be a graceful act to pass a vote of condolence to his widow, under the trying circumstances in which she was placed. The Board would be better able to know whether any substantial recognition of Mr. Rowsell's services should be given to his widow, and, if they thought so, he was sure that every Shareholder would be liberal on such an occasion.

Mr. DODGSON thought, as to the latter part of Mr. Morrison's remarks, that every gentleman should be left to act as he pleased, and clear his conscience in his own way.

Mr. STEPHENSON CLARKE said that he was a pretty large Shareholder in the Company, and he thought it was only right that they should recognize Mr. Rowsell's services. He should propose that a sum of £200 be given to his widow.

The CHAIRMAN said that it was very pleasant to hear the remarks of the Proprietors as to Mr. Rowsell, for they were so much in accord with their own views in the matter; but the question at present before the meeting was the approval and adoption of the report and accounts, and, unless any one had anything further to say on that motion, he would put it.

Mr. DODGSON considered that the expenses of the Company, in proportion to the business done, were very heavy. They were so large that the Directors could not be surprised at the dissatisfaction which had long existed in the minds of the Proprietors. The death of their late Secretary afforded an opportunity of diminishing expenses. He wished to know what the views of the Board were as to the expenses, and what diminution might be expected for the future.

The CHAIRMAN said Mr. Dodgson considered that the expenses of the Company were unduly large for the amount of business done. He (the Chairman) was not prepared to make comparisons between their expenses and those of Companies similarly situated, but, from what they knew about the matter, they did not share Mr. Dodson's opinion in that respect. They knew that they were large, but in such a way that they could not well be avoided. Although the expenses were large, the working of the Company was exceedingly good. For instance, the amount of gas sold and brought to charge for every ton—and he knew of no better criterion of the working of a Company than that—was very satisfactory indeed. The real defect of this concern was the great difficulty of getting an increase of business. Every Gas Company owed its prosperity to its gradual rate of increase, which this Company had been without. It would be possible for them to do a very much larger business without seriously adding to the expenses. He could not see any way by which those expenses could be reduced to any important amount.

Mr. DODGSON remarked that there was a mode of reducing expenses applying to this and to all small Companies, and that was to work two or three Companies in one office. This Company was, in his opinion, too small to have a separate establishment, and it might very well be worked in combination with other Companies. If this were done, a reduction might be effected of some £300 or £400.

The adoption of the report was then put, and carried *nem. con.*

The CHAIRMAN moved the declaration of the following dividends:—At the rate of 7 per cent. per annum on the first preference shares, 7½ per cent. per annum on the second preference shares, and of 2½ per cent. on the ordinary capital, payable on the 15th of July.

Major SUART seconded the motion, which was carried unanimously.

Mr. PAUL proposed the re-election of Mr. Paddon. He said he was not aware how long that gentleman had occupied the chair, but on every occasion that he (the speaker) had been present Mr. Paddon had been able to make a statement satisfactory both to those Shareholders who attended the meetings and to those who were absent.

Mr. W. T. MORRISON seconded the motion, which was carried unanimously.

The CHAIRMAN returned thanks for the kind way in which the Shareholders had re-elected him, and said he could assure them that he keenly appreciated both the honour and the duties devolving on him. He asked them to be good enough to re-elect their Auditors. Their re-election was entirely in the hands of the Shareholders.

The Auditors having been re-elected, their remuneration was fixed at the usual rate of 20 guineas each.

The CHAIRMAN then asked the meeting to proceed to the election of a Secretary. The Articles of Association provided that the appointment and removal of the Secretary should be in the hands of the Shareholders, but that his remuneration should be with the Board. The direction of the Articles in this respect was open to question, and it was sufficient to say that it was in direct opposition to the statutory regulations—the Companies Clauses Act, 1845—by which nearly all the Gas Companies in this kingdom were regulated. He, however, did not think they could do better than follow their Articles of Association. It would be a serious thing for the Directors if they were to have imposed on them a Secretary who was an entire stranger to them, and who would come as a stranger to his duties. He thought nothing would be more embarrassing and disadvantageous to the Company's interest, if this were to happen; but still the election was in the Shareholders hands. He would only say that Mr. Duffield, who was Secretary *pro tem.*, had been connected with the Company from the beginning, and therefore he was intimately acquainted with the details of the Company's business. If the Shareholders choice should fall on Mr. Duffield, it would be very gratifying to the Directors. He was the only gentleman who had given notice to the Directors of his intention to offer himself as a candidate.

Mr. STEPHENSON CLARKE proposed Mr. Duffield, who, no doubt, was most intimately acquainted with the Company's affairs. He had faithfully served the Company as Clerk, and, by electing him Secretary, he thought it would be only what was right, and a sort of encouragement for people to do their duty.

Mr. DODGSON seconded the motion, but thought the appointment should be made with the understanding that it was not to be a vested interest, and that it should not stand in the way of what he had advocated—carrying on their offices with other small Companies.

The CHAIRMAN thought that Mr. Duffield was to be congratulated for being so influentially supported. He himself was very pleased to see such unanimity prevailing on this matter.

Mr. DUFFIELD was then declared duly elected, and, in reply, thanked Messrs. Clarke and Dodgson for their support, and the Shareholders for their kindness. He would try to do his duty, and next year he hoped they would have a better balance-sheet than this year.

Mr. STEPHENSON CLARKE then proposed that the Directors should pay out of the funds of the Company £200 to Mrs. Rowsell.

The motion having been seconded, a short discussion followed, and in the end,

The CHAIRMAN thought perhaps that the case would be met if the Directors were merely recommended to carry out what had been proposed by Mr. Stephenson Clarke.

This course having been assented to,

A vote of thanks was passed to the Auditors, on the motion of the CHAIRMAN.

Mr. MORRISON moved a vote of thanks to the Chairman and Directors for their administration of the Company's affairs. Since the Chairman had been at the head of their affairs, the property had improved in value, and the business of the Company had increased. He was satisfied that Mr. Paddon's practical knowledge of the business had been very efficient. He was sure that the Shareholders felt greatly indebted to the Board. He hoped that in future the statements would be even more encouraging than they were that day. At each of their stations there had been an increase in the sale of gas, and he should imagine that as the cities where they had stations increased in size, so would the consumption of gas increase.

Mr. STEPHENSON CLARKE seconded the motion, which was carried unanimously.

The CHAIRMAN: We thank you very sincerely for your kind vote. We appreciate the act very much, and we shall always regard such expressions of your opinion as very valuable indeed.

The proceedings then terminated.

SALES OF PROVINCIAL GAS SHARES.—On the 19th ult. six old and there new £10 shares in the Boston Gas Company were sold by auction; the former realizing on an average £18 3s. 9d. each, and the latter £14 5s each. On the 24th of June 64 B shares in the Eastbourne Gas Company were offered in the town for sale; and for fully paid-up £10 shares the average was £13 10s., while for those recently allotted, and on which £5 per share has been paid, the average price was £7 15s. On the 26th ult., at Maidstone, sixty £10 preference shares in the Maidstone Water Company were sold by auction, and realized £723; five £25 A shares in the same Company fetched £291; five £25 B ditto, £126; and seventeen new shares in ditto, £751.

CHELSEA WATER-WORKS COMPANY.

The Half-Yearly General Meeting of this Company was held at their Office, Commercial Road, Pimlico, on Thursday, June 27—JOHN DEEDES, Esq. (the Governor), presided.

The SECRETARY (Mr. Albert Gill) read the advertisement convening the meeting, the seal was affixed to the register of Proprietors, and the minutes of the last half-yearly and extraordinary general meetings were read.

The following report was then presented:—

The certified accounts for the half year to the 31st of March last are laid before the meeting; printed copies having been sent, as usual, to the Proprietors.

On a review of the accounts of the Company for the complete financial year ended on the 31st of March last, it appears that the total revenue of the Company amounted to £95,881 5s., and the expenses of maintenance and management to £31,826 18s. 7d., and that after charging the account with all such expenses, and with dividends and interest accrued and declared to the 31st of March last, there remained on that day the sum of £48,361 19s. 3d. available for the payment of the half year's dividend, to be declared this day on the ordinary stock of the Company.

The revenue account for the year shows an increase of £1118 13s. 11d.; and an addition of £3392 16s. 11d. to the working expenses, due chiefly to increased rates and taxes, to maintenance charges on the new works at Molesey, and to an exceptional charge for repairing the mains between Kingston and Putney Heath. The dividend account also has been charged with a further sum of £2204 for dividends on the last issue of preference stock.

The expenditure on capital account in the financial year amounted to £33,625 13s. 11d.

The whole of the sum of £40,000, authorized on the 20th of December last to be raised by the creation and issue of that amount of 4½ debenture stock, with deferred interest, has been taken up by the Proprietors or their nominees. Bonds to the amount of £10,700 have arrived at maturity, and have been paid off, and the bond debt is now reduced to £8000.

During the year 5994 yards of additional main and service pipes have been laid in the district, 92 houses have been pulled down, and 374 new supplies have been laid on, producing a net increase of 282 additional supplies, representing an estimated additional income of £1200.

The total quantity of water supplied to the district in the year was 2963 million gallons.

The Company are providing for giving a constant supply in the Cadogan and Hans Place Estates, Chelsea, in the Elm Park Estate, Chelsea, and in the houses built and building on the Thames Embankment, Chelsea.

The Company's works and property, with the exception of two of the pumping-engines, now under repair, are in good order.

The Contractor's accounts for the construction of the new works at Molesey have all been settled and paid, with the exception of a small balance due to them on the contracts for the reservoirs, engine-house, and cottages.

The reservoirs at Molesey have now been in use for several months. Colonel Bolton, the Government Water Examiner, states in his last reports that "the works of the Chelsea Company at Molesey are working very satisfactorily, that the Company have now the means of supplying effectually filtered water, at all times, in ample quantity; that the new intake is closed when the river is in bad condition, and the supply is drawn from the impounding reservoirs."

The two Bills in Parliament, introduced by the Metroplitan Board of Works, at the commencement of the present session, one for the purchase of the Metropolitan Water Companies undertakings, and the other for the construction of works for providing a separate supply of water from wells, for drinking and culinary purposes and the extinguishment of fires, have been withdrawn. A very large expenditure has necessarily been incurred by the Companies in collecting and preparing evidence in support of their intended opposition to these Bills.

A Bill has been introduced into Parliament, by the Conservators of the River Thames, for the extension of their powers, and proposing that further contributions shall be made by the Thames Companies in consideration of advantages accruing to them. The Bill, in the present form, as passed by the Committee of the House of Commons, is not satisfactory as regards the Companies interests, and the Directors have joined with the other Thames Companies in a petition to the House of Lords, with a view to obtain a satisfactory amendment of the Bill

Three Directors—viz., F. S. Clayton, Esq., Colonel Sir Wilford Brett, and Sir William Henry Wyatt—go out of office by rotation, but, being eligible, offer themselves for re-election. One of the Company's Auditors, J. A. Hallett, Esq., also retires by rotation, and offers himself for re-election.

The Directors recommend to the Proprietors that a dividend at the rate of 6 per cent. per annum be now declared on the ordinary capital stock of the Company, and paid, as usual, on the 5th of July next.

Dr.—REVENUE ACCOUNT, FOR THE HALF YEAR ENDED MARCH 31, 1878.

Maintenance.			
To Maintenance and repair of impounding and service reservoirs, filtering-beds, works, and pipes, or for obtaining and storing water, including the cost of materials and labour	£763 11 3		
Maintenance and repair of mains, pipes, fittings, meters, and works connected with the distribution of water, including the cost of materials, labour, and renewals	2,182 13 10		
Pumping and engine charges, including cost of coals, wages, &c.	3,951 7 10		
Filtration, including the cost of materials and labour	392 16 8		
Salaries of Engineer, Inspector, Superintendent, and Clerks, and wages of Turncocks	1,810 17 10		
Thames Conservancy	500 0 0		
Rates and taxes, exclusive of income-tax	2,316 6 3		
		£11,917 13 8	
Management.			
Allowance to Directors	£613 17 9		
Allowance to Company's Auditors	40 17 0		
Salaries of Secretary, Accountant, and Office Clerks	1,030 19 9		
Superannuation of servants of the Company	301 11 8		
Commission to Collectors	999 5 4		
Stationery, printing, and general establishment charges	384 9 11		
Law and parliamentary expenses	500 0 0		
Official Auditor and Water Examiner	59 2 4		
		3,930 3 9	
Dividend and interest account for transfer of profits		29,195 12 9	
Balance carried to next account to provide for losses		2,000 0 0	
		£47,043 10 2	

Cr.—REVENUE ACCOUNT.

By Balance brought from former account	£2,000 0 0		
Less sums written off as losses, viz.—			
Empty houses, houses cut off, and bad debts	1,659 16 5		
	£340 3 7		
Water-rents accrued to date of this account	46,398 6 0		
		£46,738 9 7	
Rents of houses and lands accrued to date, and owing to the Company		297 5 7	
Fees received for registration of stock transfers, &c.		7 15 0	
		£47,043 10 2	

The GOVERNOR said: I have now to move that the report which you have just heard read be received and adopted and entered on the minutes. Before doing so, however, I wish to make a few remarks on some of the paragraphs of the report. In the first place, I desire to state that we have found it more convenient to take the accounts for the whole year, up to the 31st of March last, because we think that in this mode a fairer estimate can be formed of the accounts, inasmuch as in several respects they vary in each half year. By taking the whole financial year you get the whole expenses, and the whole receipts, whereas that information is only partially supplied, not evenly supplied—if I may say so—in taking each half year. As is stated in the report, the revenue account has increased for the year by £1118, of which £992 has accrued from improved water-rental. It is also stated that the working expenses have increased by the sum of £3392. That increase is mainly attributable to our new works at Molesey, and matters connected with them. It will be palpable to the meeting that such would necessarily be the case. The increase of rates and taxes is £940; in maintenance charges for the new works, £780; repairing a main—which was an accidental occurrence—£450; making £2170 out of the £3392. Of course, we must expect in future that the maintenance charges and rates and taxes must be increased. With regard to the sum of £40,000 which the Directors were authorized, at the December meeting, to raise from time to time, that debenture stock has been taken up at 4½ per cent. This exhausts the £200,000 which the Company were empowered to raise by their Act of 1871. We had raised £160,000 previously by preference stock, and the £40,000 of debenture stock was remaining, and completes the sum of £200,000, which, under the Act, we are entitled to raise for our Molesey works. That estimated outlay of £200,000, I am happy to say, very nearly corresponds with the actual outlay—as near as about £3000—and that on a large outlay of £200,000 is, if I may say so, coming very near the mark. There are still some accounts with the contractors which are not yet settled, but they are of a very trifling kind, and will certainly not exceed the amount I have mentioned. I have the outlay before me in detail, but I will not trouble you with it. It has reached £200,900, and, as far as we can judge, there will be further expenses of about £3000. Therefore we may be satisfied and gratified that the total outlay comes so near to the sum that was thought to be required for the works we have been constructing. With regard to the remarks of Colonel Bolton, set forth in the Directors report, that gentleman is a person in authority, speaking with care and caution, and his testimony in favour of our new works is, I think, valuable. It is a very satisfactory statement coming from an officer under Government. Allusion is made in the report to two Bills in Parliament which were promoted by the Metropolitan Board of Works, who, under what we call the Purchase Bill, proposed that the Companies should be bought up; and the other Bill was for providing a separate supply, to a certain extent, for drinking and culinary purposes, from wells in different parts of the country—some in Kent, Sussex, Surrey, Hertfordshire, and other places. These Bills dragged their slow length along, if I may say so, for some time, but never made any rapid progress, and were finally withdrawn. The only misfortune attending it was that it involved expenses. All the Companies taking water from the Thames acted as one in the matter, but still the necessity of collecting and preparing evidence, and everything connected with it, was a matter of considerable expense. I cannot tell you what the proportion falling on this Company will be. Besides these two Bills, there is a Bill called the Thames Conservancy Bill, which, no doubt, proposes to considerably extend the powers of the Thames Conservators. It gives them a much larger and wider control than they had before over tributary streams that discharge their water into the Thames. One object of the Bill is, I think, to enable the Conservators to go higher up these tributary streams than they have been able to do hitherto, and thereby see and stop, if necessary, the action of mills, &c., in pouring refuse water of an exceptional kind into the Thames. Then the Companies taking water from the Thames at present pay in aid of the Thames Conservancy authorities £1300 a year each, with the exception of the Lambeth, which pays a little less; and it was part of the proposal of the Bill that the sum of £1300 should be increased by £1000 a year from each Company. I think that there is very little doubt that, if the Bill passes at all, it will contain a clause by which we shall pay in future £2300 a year instead of £1300, as before. I have, on former occasions, referred to the waste inspection, and that has been proceeding, and we find that great benefit has arisen from it, from the improvement of fittings and other matters, which the Inspectors have been able to regulate and control. I think I may congratulate you on the completion of the works at Molesey. They have gone on quietly and steadily, and I think in a way that entitles us to give our thorough commendation to all parties who have been concerned in them. I will not further trouble you, but will move—"That the Directors report be received and adopted, and entered on the minutes."

Mr. J. S. WIGG, a Shareholder, in seconding the motion, asked if the bonds of £8000 paid off were a temporary loan, or taken up by debenture stock. Had the amount been paid out of income?

The SECRETARY said that the sum had been paid off from the loan capital. The whole of the loan capital at one time was raised on bonds, but it had now been converted into debenture stock. This particular sum had been paid off from the issue of last month of debenture stock, which was raised independently of that. It had been paid off out of capital—paid off, not renewed. It had fallen back into loan capital, and could be raised by-and-by, either as bond or debenture stock.

Mr. WIGG also asked if there was any reason why the report should not be printed.

The GOVERNOR thought that in this matter they had probably followed the course generally adopted. If a wish was expressed as to it, they would be happy to take the matter into consideration.

The report was then unanimously adopted.

The GOVERNOR then moved *seriatim* the following resolutions, which were unanimously passed:—"That the accounts, as laid before the meeting, be received and entered on the records." "That the Directors be, and they are hereby, authorized to set apart and pay so much money on the 5th day of July next as will be sufficient to discharge the dividends which will become payable on that day upon the preference stocks." "That a dividend for the half year at the rate of 6 per cent. per annum on the ordinary capital stock of the Company be now declared, and paid on the 5th day of July next to the several persons and corporations who are proprietors of such capital stock." He also notified to the meeting that three gentlemen went out of office—Francis Stephen Clayton, Esq., Colonel Sir Wilford Brett, and Sir Wm. Henry Wyatt. They offered themselves for re-election, and he moved their re-election collectively.

The motion was seconded and carried unanimously.

Mr. CLAYTON, on behalf of his colleagues and himself, returned thanks for the confidence shown in them.

The GOVERNOR then stated that Mr. J. A. Hallett was the retiring Auditor, and he offered himself for re-election. He moved that that gentleman be re-elected.

The motion was seconded, and also carried unanimously.

The GOVERNOR intimated that this closed the business of the meeting.

Mr. ADAMS: I think that we ought to pass a vote of thanks to the Governor for so ably presiding over this meeting, and to express the pleasure the meeting feels at seeing him completely restored to health. I hope he will continue to enjoy good health.

Mr. ASTON seconded the motion, which, of course, was carried unanimously.

The GOVERNOR, in reply, said: Gentlemen, I am much obliged to you for the compliment you have paid me. As long as I am able, I will give my attention, as I have always done, to the interests of the Company in promoting them in every way.

The proceedings then terminated.

GAS AND WATER COMPANIES DIRECTORY, 1878.—Mr. Charles W. Hastings, of Buckingham Street, Adelphi, London, has just issued a second edition of this handy book. It contains much useful information for Gas and Water Managers, and for manufacturers of apparatus, &c. The work has been enlarged by about 90 pages, and has, the compiler states, been thoroughly revised as well as added to.

BRITISH ASSOCIATION OF GAS MANAGERS.

The Fifteenth Annual General Meeting of the Members of this Association was held in London, on Tuesday, the 18th, and Wednesday, the 19th ult., at the Rooms of the Society of Arts, John Street, Adelphi—CORBET WOODALL, Esq., M.I.C.E., the President, occupying the chair.

TUESDAY, JUNE 18.

The PRESIDENT took the chair at ten o'clock this morning.

The minutes of the last general meeting, and the statement of accounts, which had been previously printed and circulated, were taken as read, and confirmed.

NEW MEMBERS.

The SECRETARY (Mr. W. H. Bennett) read the following list of names of gentlemen applying for membership:—

ORDINARY MEMBERS.

Broadberry, W. T.	Southend.
Canning, T.	Newport, Mon.
Carpenter, S.	Bow Common.
Carter, H. W.	Winsford.
Chapman, J.	Harrow.
Chester, W. R.	Greenwich.
Culver, G.	Hythe.
Daley, W.	Invercargill, N.Z.
Darney, R., jun.	Bournemouth.
Davis, G. J.	Birmingham.
Dawson, W. C.	Arundel.
Dozell, H.	London.
Halkett, R.	Bicester.
Irvine, G.	Ripon, Yorks.
Latchford, W. J.	Broadstairs.
Leather, J. P.	Burnley.
Linging, F. E.	Norwich.
Marshall, F. D.	Brentford.
Newton, A.	Hong Kong.
Palethorpe, W. W.	Doncaster.
Parsons, S.	Bury.
Sheppard, T. L.	Farnworth.
Shonbridge, S. Y.	Birmingham.
Walker, J.	Colney Hatch.
Wilshaw, W. G.	London.
Wilson, R.	Croydon.
Wood, W.	Colnbrook.
Yates, E.	Shaftesbury.

EXTRA-ORDINARY MEMBERS.

Booth, J.	Hazelhurst.
Chandler, J.	London.
Chandler, S.	London.
Davies, F.	London.
Davis, G. E.	Manchester.
Richardson, W.	Newcastle-on-Tyne.
Stephenson, A.	London.
Wallace, R. W.	London.
Woodward, J.	Manchester.
Young, J. R.	Newcastle-on-Tyne.

On being put to the vote, the whole of the above were unanimously elected Members of the Association.

The PRESIDENT then proceeded to read the following

INAUGURAL ADDRESS.

Permit me, before proceeding to the business of our meeting, to express my cordial thanks for the honour you have done me in electing me to this chair. I regard the position of President of the British Association of Gas Managers as the highest open to members of our profession, as such, and I value accordingly the confidence you have been pleased to repose in me.

I occupy the chair this morning with much of personal misgiving, but with strong confidence in your generous help. I earnestly hope that this may prove not the least interesting and profitable of the gatherings of our Association, and that throughout there may be manifested a vigorous interest in the matters under consideration, combined with perfect harmony and mutual respect.

I have felt for several years past that the time at our disposal for these annual meetings is too short; very soon I hope it may be possible to extend the three days to at least four. In the meantime, in order to get the maximum of advantage out of our short session, it is necessary that all the time possible should be given to the papers and discussions, and it is to this end especially that I shall need to ask your watchful and constant co-operation. Our formal and official business must necessarily occupy some rather considerable time; but, I venture to suggest, not so much as it has occasionally done. I hope also that gentlemen who purpose speaking on any particular subject will immediately avail themselves of the first opportunity for so doing.

It is very gratifying to observe the continued growth and prosperity of our Society. The success which has attended it throughout has been remarkable and uninterrupted, and our numbers have increased so rapidly that we shall soon be shut out from the possibility of obtaining more recruits, because all the men will have been enlisted. We find also less difficulty in obtaining papers; the quality of the communications is fully maintained, and our discussions become more general.

Our muster-roll is such as few scientific or technical societies can point to, as the growth of so short a period, and it is one of which we may be justly proud. At the same time it puts upon us an obligation to furnish fruit worthy of so fair a tree; for a crop that would be creditable to a young vine in its early days, would be unworthy of it when a dozen years in passing had helped it to maturity of strength and vigour.

Of the fruit already borne, not the least important, in my opinion, is the foundation, in various parts of the kingdom, of district Associations, with objects similar to our own.

Our Society is perhaps young to undertake the cares of maternity; but a mother she is, and that of a rather large family. The anxiety of the parent is less than it might have been, because the children are so remarkably strong and healthy—indeed, they remind one of that prodigious birth recorded in classic story, when Minerva issued full-armed from the brain of Jupiter, rather than the ordinary and prosaic method, so little have they manifested of the dependence and weakness of infancy.

That these Associations may prosper abundantly we all truly hope. They have one material advantage in being able to meet more frequently than is possible with us, the members having to be drawn from shorter distances. These more frequent meetings not only give time for more careful consideration of the subjects brought forward, but they also tend to the formation of friendships, most useful and pleasant, among men who, though living near each other, might, without such aid, remain as perfect strangers as next-door neighbours are supposed to be in London.

As to the influence of these Societies upon our own, I entertain no fear that it will be anything but favourable. The stronger the individuals become, the better for the body in which they are united. The one evil that occurs to me as possible is, that members, finding it impossible to prepare two papers, may give preference to local claims, and we may run short in consequence. This is not likely, but, to put it out of question altogether, I would suggest that each District Association should charge itself with the responsibility of furnishing from among its members at least one paper annually to the parent Society. If this suggestion be adopted, not only shall we be sure of abundant matter, but there will be an element of friendly rivalry introduced that must have a beneficial influence on the quality.

Some concern has been expressed on recent occasions at the fact that our financial balance has slightly diminished. Although the accounts of the past year show an improvement in this respect, yet it is not a considerable one, and I venture to ask that there may be a still larger response to the invitation given by our past Presidents, that such members as can afford it will increase their subscriptions to a guinea. I do not ask this on the ground that it is desirable to increase our reserve materially, but because we should be lifted beyond the necessity of discussing reduction of useful expenditure, and because also we have by no means reached the limit of profitable spending. This is a matter that has never caused me the least concern, because I know that we all feel too deep an interest in, and affection for, our Society to allow it really to suffer on this ground.

Looking at the enormous importance of the gas industry now, it is hard to realize that the generation which saw the incorporation of the first Gas Company has not yet passed away. (Our astonishment is not diminished, but increased, when we remember that the same is true of the railway system, and many other of the great industries giving employment to the Civil Engineer.) Year by year, with steady strides, the demand for gas has advanced, and with it the demand for gas-makers. In the earliest days of gas lighting, men had to feel their way step by step, and many years were occupied in bringing the manufacture to anything like a complete system. For a long time the business of gas-making was regarded by the general public as something secret and mysterious, and the management was in the hands of a very limited number of men. By degrees, however, this condition of things has been altered, and the study of the construction and management of gas-works is as open as any other branch of engineering to whoever chooses to enter upon it.

I make these remarks because I wish—treading in the steps of several of my predecessors in this chair—to draw the attention, especially of our younger members, to the growing necessity for thorough preparation on the part of those who are to follow, and obtain success in the profession of Gas Engineering. I say nothing on the question of early education; that is a matter over which the student has usually little control. Happy is he whose parents are able and willing to afford him a good one; for the youth whose mind has been trained to concentrated and systematic work, starts with as great advantage over one not so fortunate, as in a race a public-school athlete would have over a ploughboy. But it is after school has been left behind, and actual work has been commenced, that a man's training frequently begins. Under the spur of felt necessity, of active competition, he can do much in his hours of leisure to fit himself for a successful career, and under such stimulus the ploughboy does sometimes come to the front. But remember, gentlemen, it is not *as* the ploughboy. The men who "make their own way," in spite of early disadvantages, do so at a cost of labour and toil out of proportion to what it might have been, and honoured should they be in the same degree. All such men put a high value upon early training, and readily admit that they would have been the better for it. The early years lost cannot be made up for; duties and responsibilities grow, and a man finds his time fully occupied in meeting these, and none left for catching up arrears. I readily admit that this has always been the case. What I urge is, that the question of training becomes year by year of greater moment; "rule of thumb" less possible; and, to quote a remark of Mr. Bruce Bell, "an uneducated engineer is as likely to succeed as an uneducated schoolmaster."

In our case, the growth of the business of Gas Companies involves the necessity for works of constantly increasing magnitude, and this again brings added responsibilities in management and control, as well as the necessity for further acquaintance with the principles of construction, while the demand for refinements of purification, coupled with the obligation to avoid offence on the works, makes still further demands on the care and ability of the Manager.

Then also the Legislature has from time to time, as the natural development of our industry and the improvements and economies effected by the Companies have rendered it possible, reduced the maximum price chargeable for gas; every such reduction making it more imperative that those interested with the management should be alive to the progress effected, should know what is being done by others, and be capable of comprehending and applying for themselves processes which tend to improve or cheapen production, and thus to the advantage of their employers and the public. In short, gas-making is in the same category with all other great industries of a scientific nature in this respect, that year by year the demand upon those who conduct it, for increased intelligence and skill, becomes greater; while the steadily improving character of the general education of the country causes the race to be keener and the competitors to be more in number for the prizes which it has to offer.

To help us carry forward our profession, at least in line with the general progress around us, is the mission of this Association, and although it cannot take the place of individual effort, it can, and does, worthily second it.

If such is the work of our Society, it has an interest and a value to Gas Companies as well as to ourselves, and I am very glad to know that this is now widely recognized. I would strongly advise all members who are Managers of works to make a point of specially reporting to their Committees or Directors upon the work done at each of our sessions. In this way an intelligent interest in our proceedings will be maintained, and employers will see that the money spent in paying their officers expenses to our meeting is well invested.

The subject of remuneration is one that I feel we can do little good by discussing here. It is one to be settled by the two parties to the engagement, and will be governed, to a large extent, by the law of supply and demand in the first place, and by the proved value of the officer himself subsequently. There is one aspect of the question, however, upon which, with your forbearance, I will say a few words.

In the JOURNAL OF GAS LIGHTING, No. 715, appeared the following remarks:—

"It seems to be a common belief that all gas officials are highly paid, but no grosser delusion ever prevailed. There are a few—very few—who receive well-earned, large salaries; but we repeat, without fear of contradiction, that a vast majority of Gas Managers are most inadequately rewarded. They are required to know something of many arts, and several sciences. They can hardly be said to have peace night or day, and, at times, their duties are of a most onerous character; and when they have done all, they often receive less than a banker's or a merchant's clerk, who has only to make entries and add up figures from ten to four o'clock. Struggling Companies may have some excuse for parsimony; but, if we might select some of the worst cases of inadequate payment, we should take them from our corporate towns. Here, too, it may be said, there is an excuse, for we have recently read of indignation meet-

ings being held to remonstrate against the addition of £50 a year to the salary of a most valuable gas officer.

"We feel bound to insist on this matter, for, in our opinion, it lies at the bottom of all the mischief of which complaint is now made. Pay a man well, and then you may expect or require him to be immaculate. It is, from a moral point of view, sad to think that men require to be bribed, as we might say, to be honest; but such, in a limited sense, is the fact. You must place men above temptation before you can expect them to resist it."

This, as many will remember, formed part of an article dealing with the question of the payment and acceptance of commissions, which had been raised in the columns of *The Times*, and other papers, and was continued in the JOURNAL. I refer to it here from a conviction that the subject is one that materially affects both our reputation and our prosperity. That inadequate salaries justify the acceptance of commissions, no one here will, I think, maintain; but that they increase the temptation cannot be questioned.

I wish, however, to point out that, while small salaries tempt to commissions, commissions tempt to small salaries. It does happen, and will continue to happen so long as the system remains at all, that some men will be found willing to accept duties at inadequate remuneration, purposing to make up by this means, while those who decline commissions have to be content with such salaries as would be accepted by the former class. The restriction of salaries is not the only wrong the system does, for it brings undue suspicion on those who do not join in it, and makes possible wholesale charges of a most unjust nature.

The acceptance, by a paid agent of a principal, of fixed or more or less well understood per centages on the value of goods purchased, or contracts made, is as morally indefensible as any system of bribery, and yet who does not know how plausible are the arguments used by those who offer them? It is pleaded that they are only a deduction from the profits, and no loss to the principal whose agent receives them. But I would ask, supposing these payments to be abolished, by what special arrangement of political economy would competition be prevented from reducing prices by their amount?

In a leading article in *The Times* of the 6th inst. appear the following passages:—"The practice of receiving commissions has been pronounced illegal in every way, and this in terms which will make it impossible for any man to meddle with it with a notion that he can be acting honestly. A usage, however prevalent, which is declared to be corrupt in itself, and opposed to common morality, must be held to go far beyond the doubtful border-line at which impropriety begins. The man who can receive a commission, and not be biassed by it, who can form as independent a judgment as if he himself had no personal stake in the matter, and can look after his employer's interests as sincerely as if he had not been paid for betraying them, must be so rare and so superhuman an exception, that the Queen's Bench Judges were fully justified in not enlarging the law on his account. It is obvious, too, that to one side or the other a commission must be unjust. If the receiver of it does the work he is paid for, it is his principal who will suffer. If he takes it and does nothing for it, it is hard to see what sort of defence he can make for putting it, thus unearned, into his pocket. But, whatever the exception may be, there is no doubt as to the rule which will hold good in ninety-nine cases out of one hundred, if not in the hundredth too. His judgment, if he cares to think about the matter at all, will be influenced in the way intended, and he will give advice which is not the best, or will accept terms which are less favourable than they might have been. The arbiter who receives a bribe is not held to be excused, even if he can make out that he has remained indifferent in spite of it. There was a breach of trust committed in the mere receiving it, and it is idle in such a case to speculate on what the after consequences may or may not have been."

I must ask your indulgence for entering on a subject so delicate, and in many ways distasteful. I have done it because I felt that to pass it by was the graver fault.

I know that there is no special reason for addressing such observations to Gas Managers, more than to any other body of commercial or professional men. I know also that the statements that have been made as to the general prevalence of the custom are gross calumnies; but so long as commissions are offered and accepted, I think it our duty to protest against them. That many employers lend themselves to the practice they condemn, by paying salaries below the value of services rendered, there can be no doubt; that some even wink at the custom, as justifying them in such a course, is, I am told, a fact. But no such circumstances make it one whit less objectionable; they do but show more broadly its pernicious effect. I have never heard other than one opinion expressed on this matter by Managers or Manufacturers, and that of Directors can admit of no doubt; all alike condemn the practice and deplore its results. Mutual jealousies on the one side, and possibly respect for ancient usage on the other, keep it alive. In expressing a hope that the custom may soon be entirely surrendered, I feel sure of the concurrence of this assembly.

I have to congratulate you on the list of papers submitted this year for our consideration; they are all devoted to matters of great interest, and will deserve all the time we can give to them. At the same time, though there is not one of the list that we would wish displaced—and we certainly have not room for more—I do regret the absence of papers descriptive of works of a mechanical or engineering character, in progress or recently completed. Members are constantly engaged in the construction of new apparatus or buildings, and the materials are consequently never wanting. Such works occupy much of our time and thought, and would be as profitable in discussion as any that could be chosen; while we all recognize the important bearing which the judicious expenditure of capital has on the success of a gas undertaking. I presume that Mr. Livesey's paper will treat of this latter subject, and it is one worthy of his able pen.

I have already referred to the demands which gas engineering increasingly makes upon constructive ability and scientific knowledge; but the fact must not be lost sight of that gas-works belong to what are essentially commercial enterprises, depending for success, to a remarkable degree, upon the manner in which engineering and science are directed, and even held in check by economic considerations.

There must be, for instance, but a sorry sort of satisfaction to the man who finds himself in charge of works, admirable in design and workmanship, and replete with every modern improvement, but necessitating the imposition of a sum, equal to seven or eight times the net cost of coal, to pay the statutory dividend thereon. I am not exaggerating when I say that there are places to be found where the coal, less residuals, costs but 3d. or 4d., and a 10 per cent. dividend, 2s. to 2s. 6d. per 1000 cubic feet of gas sold; or, in other words, the dividend alone, in one town, may absorb a sum nearly equal to the selling price of gas in another, and yet the management in each case may be equally efficient, and all the manufacturing charges the same, the whole difference being due to the disproportionate expenditure on plant in one case as compared with the other. The time was when comparatively little heed was given to this aspect of our business. Works were erected, a statutory price sufficiently high was obtained, and that was a successful undertaking which paid full dividends. But the publication of the analysis of London Gas Companies accounts by Mr. Field has brought home to every Manager a ready means of comparison, and has no doubt imbued many with a healthy spirit of competition.

I am disposed to think that if ever the public did suffer on account of the monopoly of Gas Companies, that can now only be the case in very rare instances, most Companies regarding themselves as in competition with every other similarly circumstanced, and striving to excel in providing superior advantages to their consumers. On these grounds, Mr. Livesey's paper will be of much value, if it goes to determine the relation that capital should bear to revenue.

Mr. Methven's paper will be listened to with interest, as promising a solution of the vexed question of a true standard for photometrical observations. Mr. Methven has brought his mind with his eyes to the photometer, and I think you will consider the result very satisfactory. I hear with much pleasure that we are to be favoured also with a description of the means by which Mr. Vernon Harcourt has sought to reach the same end by the preparation of a gas of constant quality.

Permit me to refer to one other of the papers on our list. Some weeks ago, at the invitation of Mr. Carpenter, I visited Sheerness, and saw there the system of retort-setting and arrangement for automatic feeding which he is to introduce to you. I do not now express an opinion as to the probable success of Mr. Carpenter's plan; of that you will be able to judge from his drawings and model, even if the paper should not be reached. I simply wish to express my hearty admiration of the care with which the arrangement has been worked out, and of the perseverance with which it has been followed up, under circumstances of no encouraging character. When members have the thought to conceive, and the courage to spend time, labour, and money in carrying out an idea which promises to result in improvement, this Association will always give its praise and help, even though the scheme be denied success. In no direction, I do not hesitate to say, notwithstanding the trials that have been made and the failures that have resulted, can the inventive skill of Gas Managers be more wisely directed than towards the attainment of a good plan of continuous carbonizing. That it will be done some day I have no doubt, and even many failures should not turn us aside from the search after what might prove, in economy, efficiency, and accuracy of manufacture, an illustrious step forward.

The past year has seen no alteration in the course of parliamentary dealings with Gas Companies, and it is a sign of the times that this should be a matter for remark. So many have been the changes and modifications of the treatment dealt out by Committees, in recent years, that there has resulted a feeling of unrest and expectancy which is much to be deplored, and which is grossly unfair. The consistency of the last two sessions I would characterize as a persistent continuance in ill-doing; for the imposition of auction clauses, which all Companies have had to submit to, is, to my mind, unjust in the extreme. I cannot see any reason why a body of men, who have borne the expense and run the risk of founding a business, and who have diligently cultivated that business until it has become a successful one, should then be required to take in, on even terms with themselves, any one who chooses to invest his money in a good thing. I quite admit that, taken in conjunction with the sliding scale of dividend and price, as we at present know it, they are less objectionable than they would be without it, because with a fixed price, the smaller the capital upon which dividend is to be paid, the larger, naturally, will be the dividend. But there is no more finality about the normal price than there has been with the maximum price of past years. Grant, then, that Parliament may re-arrange the price, taking advantage of the economies effected by the reduction of nominal capital through the operation of the auction clauses, and the sliding scale ceases to be a compensation. Personally, though I express the opinion with much diffidence, I prefer the legislation of 1847 to any of the schemes which have in turn been substituted. I deny altogether that any inducement to economy and enterprise was required other than was afforded by the natural desire to increase our business, and, consequently, the capital invested in it. Under that Act the dividend has been in late years practically secure, so long as the works were properly conducted; and, while the Company gained the advantage of increased business, the consumer had, as he was fairly entitled to have, the advantage of such economies as were effected. The Act also furnished the Local Authorities with machinery amply sufficient to enable them to have examined the accounts of the Companies, and so see to it that the consumers had all they were entitled to. It is much to be regretted these powers were not used; had they been, there would probably have resulted more of trust in the *bona fides* of the Companies. I maintain emphatically that the Companies have striven loyally to carry out their obligations to the consumers, and that they have good reason to be proud of the success which has attended their efforts. It is not just to say that Directors have been concerned only to obtain maximum dividends, because latterly the maximum dividend has been regularly earned. My experience has been, and I believe yours will confirm it, that there has been a disposition to encourage, rather than otherwise, investigation into such matters as promised advantage to the consumer, and inventors have not had occasion to complain of rejection without trial. I regret the change; the new system brings with it an element of gambling. Shareholders will be constantly "asking for more," and weak officers will be tempted to wrest accounts so as to gratify them; while a rise in the price of coal, accompanied, as has happened before now, by a fall in the value of products, would leave the recent investors with barely any return for their money. I make these remarks because, especially, I object to the arguments on which the change was based. The Companies have laboured hard and honourably in the past; they will continue to do so, I doubt not, in the future, and that irrespective of the legislation by which their profits are controlled.

During the year there have been several cases of transfer of gas-works from Companies to Corporations, and, generally, both sides have been content with the terms. There are two or three matters of interest in connection with these, to which our friend Mr. William Livesey has kindly directed my attention, which I will shortly name.

The Corporation of Clitheroe agreed to pay to the Gas Company there the sum of £2887 10s., by way of bonus, for the uncalled portion of their shares, thus recognizing a position which the auction clauses annul. There has been a doubt frequently expressed in past years as to whether, in the event of a Company being unable to pay their maximum dividends, the reduction should be proportionate on each class of shares, or fall entirely on the original ones; this has been decided in favour of an even reduction over all ordinary stocks.

There are several new provisions intended to fence the auction clauses from abuse—that only a certain amount of capital shall be called in any one year, that the shares shall be offered in lots of not more than £100, and paid up within three months.

It is remarkable, however, that, notwithstanding the auction clauses, the dividend on new capital is restricted to 7 per cent. A share entitled to 10 per cent. dividend will always command a higher proportionate premium than one that is only entitled to 7 per cent., and therefore it seems to me clearly a mistake to fix on the lower rate.

I have little to say in relation to new processes or inventions. It is the less necessary that I should do so, as the "Treatise on Gas Lighting," now being published by Mr. King, has brought the record of improvements

really effected close up to the day of our meeting, and in the columns of the JOURNAL we have, from week to week, full information upon any matter of interest affecting our business. I understand that our friend, Mr. King, will be absent this year from the post he has occupied at the table at each of our previous meetings. I am sure you will all join with me in wishing him fully re-established health, and in congratulating him upon the deserved success which has attended his important work. Let me here acknowledge also the obligation under which we, as an Association, rest to Mr. King for giving us such help in the use of the JOURNAL type, as enables our proceedings to be published in the form we have them, and at a price within our means.

Our fellow-member, Mons. Brémond, of Versailles, has presented to the Société Technique a most admirable and exhaustive paper on the subject of the cause and cure of naphthaline. The experiments there detailed seem to support fully Mons. Brémond's theory, and I believe that subsequent trials on a larger scale have established the success of his method. This is a matter for congratulation, not only to the patentee, but also to gas-makers generally. The theory is that an excess of the vapour of naphthaline is kept in suspension in the gas by the presence of aqueous vapour, and that as the latter falls, through diminished temperature, the former falls with it.

It may readily be imagined that if a gas containing the vapour of a volatile body, together with aqueous vapour, be cooled, and the aqueous vapour is deposited in the liquid condition, this circumstance may determine, at the same time, the deposition of some of the vaporized body, even though the temperature necessary for the deposition of the latter substance alone has not been reached.

There is one aspect of the question, however, which is now receiving a considerable amount of attention, and the settlement of which may cause many of us to alter our practice in condensation. Mons. Brémond, after noting the fact that naphthaline is a result of high heat in the retort, goes on to approve the custom generally prevailing, of keeping the gas in contact with tar for as long a time as possible, so that the latter may absorb the naphthaline. This advice is somewhat peculiar, seeing that by adopting the process of desiccation, which forms the subject of his patent, the naphthaline is retained in the gas to its palpable advantage. Mr. Newbigging, in a letter to the JOURNAL OF GAS LIGHTING of the 4th inst., calls attention to the injurious effect upon the illuminating power of gas, resulting from intimate contact between it and tar, in the process of condensation, due to the absorption, not only of naphthaline, but of other hydrocarbons. That letter furnishes a concise examination of the whole question, and is of great value. Now the harmonizing of the two objects is made practicable by Mons. Brémond's system, and the result would probably be even more favourable than he promises. Remove the tar before it has commenced the absorption of gaseous hydrocarbons, dry the gas at the outlet of the purifiers, and the result would give, not only the 6 per cent. increase of illuminating value due apparently to the withdrawal of aqueous vapours, but a further per centage due to the retention of naphthaline. On this matter we shall certainly hear more at our next meeting.

As the paper prepared by Mr. Marshall, on purification by liquids, will deal with the process of Messrs. Wallace and Claus for utilizing carbonic acid, in which I feel a great interest, it is not necessary that I should refer to it here.

Messrs. Evans and Sugg are engaged in experiments—the lines of which have been explained in the JOURNAL OF GAS LIGHTING—for purifying gas by means of ammonia obtained from gas liquor, but I am not able to say how far success has yet attended their efforts. The preparation, either of caustic ammonia, or ammonium sulphide, from ordinary liquor is a difficult and costly process, and is the barrier in the way of success in this direction.

Much interest has recently been felt and expressed in a proposal made by Mr. St. G. L. Fox, and illustrated by a practical experiment in Pall Mall, to light simultaneously the lamps of a district by means of electricity. It is certainly painful to see the waste of gas—and especially such good gas as we all make—necessary, under the present system, where some lamps must be lighted in broad daylight in order that all may be kindled before dark; but this is, of course, a simple question of balancing the value of gas against the cost of lamplighters time. Mr. Fox proposes to connect, say, 200 lamps in one electrical circuit, and the action of his apparatus is thus described by the *Telegraph Journal*:—

"Each lamp is provided with a small induction coil of the ordinary make, without, however, a condenser or a contact breaker. The primary wire of each coil is in the circuit of the line wire, so that a current sent through the latter traverses the primaries of all the coils of the set of lamps on a circuit.

"The secondary wire of each coil has one end connected to the pipe, and the other brought in close proximity to the burner of each lamp, so that if the gas were turned on at each, and a powerful momentary current were sent along the line, and consequently through all the primaries, induced currents would be set up in all the secondaries, and these currents would make themselves manifest in the form of sparks jumping from the end of the wires on to the burners, and the gas at each lamp would thereby be lighted.

"To turn the gas on and off at each lamp, Mr. Fox makes use of the core of each coil. This, when magnetized by a current of moderate strength, causes a permanent magnet, attached to a stopcock of peculiar construction, to be rotated on an axis, and thereby to turn the gas on. If the current be reversed, the movement of the permanent magnet is reversed, and the gas is then cut off.

"The action of the apparatus is as follows:—When the lamps are to be lit, a positive current, say from a few cells of any kind of battery, is sent through the line. This magnetizes the iron cores of each of the induction coils, and the permanent magnet being thereby rotated, the gas is turned on. A momentary powerful positive current is now sent through the line. This sets up the induced currents in the secondaries, and the sparks from them light the gas. To turn out the gas, the current from the small battery is sent in the reverse direction to what it was in the first instance, and the permanent magnets being caused to rotate in the reverse direction to what they were at first, the gas is turned off."

The whole apparatus is very ingenious, not the least so being the cock, which Mr. Fox has designed to offer as slight frictional resistance as possible. He makes the plug slightly less in size than its socket, and filling the annulus with glycerine, finds it sufficiently sound, and at the same time free to move with very slight force. Assuming that success attends Mr. Fox's efforts to perfect the apparatus, there remains the question of pecuniary advantage. The margin, after paying for cleaning and repairs of lanterns, amounts to about 12s. per lamp per annum, out of which has to be paid interest on the rather large expenditure, maintenance of much delicate machinery, and the costs incident to the central station and the generation of the current. If these can be met without exceeding the present cost, the charming effects that would be produced nightly by its adoption should turn the scale in favour of Mr. Fox's invention.

I will now ask your attention, for a few minutes, to a question which has attracted increasing attention during the past year, and which is one of much interest to us, though having no direct connection with gas. I mean the electric light, and its possible influence upon Gas Companies.

The strides that electrical science has taken in recent years have been so great, that promises held out in its name are received with much respect, and it is not to be wondered at that great expectations are founded upon comparatively small achievements.

Although the electric light was discovered by Davy in 1813, it was not publicly exhibited, I believe, as a light likely to have useful applications, till about 1846, and even then the necessary electrical current was obtained from a galvanic battery. Now the battery, with its chemical action, has given place to mechanical force in the magneto-electric machine, where power and motion are transmuted into electricity. For a description of these machines, I will refer you to some articles which appeared in the JOURNAL OF GAS LIGHTING in December last, or to a paper read by Dr. Paget Higgs before the Society of Arts, and reported in their *Journal* of April 5 of this year. To the improvements which have been effected in magneto-electric machines, is largely due the present position of the electric light. Take an illustration from the report of Dr. Tyndall and Mr. Douglass of the Trinity House, on the lighting of the South Foreland lighthouse.

Late in 1876 these gentlemen made a series of experiments to determine the relative value of various machines, in order to qualify themselves to advise the Elder Brethren as to the most suitable one for their adoption. For some years previous to that date, the light had been supplied to the South Foreland by a machine of the construction patented by Professor Holmes, and the fair inference is, that it was, when adopted, the best procurable. The result of the trial, against a machine made by Messrs. Siemens, which proved the best, was as follows:—

Comparison of Electrical Machines.

—	Cost.	Weight.	Horse Power.	Total Light.	Light per Horse Power.
	£	Cwt.			
Holmes	550	51	3·2	1523	476
Siemens	100	3¾	3·3	4138	1523

From these figures it will be seen that, on the important item of first cost of apparatus, the comparison stood thus:

Sum required to produce light of 1000 candles—

Prior to 1876	£361	0	0
Present time	24	0	0

or in proportion of 15 to 1.

The importance of so considerable a reduction in charge for plant needs no comment. So far, however, these advances have barely any special interest to us, for the light produced from each machine, equal to from 700 to 1000 candles as a minimum, was necessarily concentrated in one centre, and the sphere of its application was consequently very limited. The great power of the light was its weakness. But we are told this difficulty is being removed, if it has not already vanished. Various methods have been devised for breaking up the current from one machine, so that many lights may be supplied from it, presumably of less intensity, and consequently more adaptable to general use. Now, I venture to say that the progress made in this direction is practically almost *nil*. What has been accomplished is, so far as I understand it, as follows. Some makers have succeeded in so constructing large electrical machines that it is possible to establish several complete circuits from each. In other words, four or five machines are rolled into one, and on to the circuit of each of these wires can be attached several (say, five) lamps or candles, and in this way one machine supplies 20 lights. But I need hardly point out that this is not subdivision of the light. Each of the lamps so supplied is as powerful as would be one supplied direct by a small machine, and the extinction of one lamp puts out all the others on that circuit.

It would appear that the minimum power and intensity of the electric current necessary to the formation of the Voltaic arc is such that a light of moderate power is not attainable. But the fact remains that the light is now applied in various places, especially in Paris, in substitution for the light of gas.

An influential Company have been established in Paris for the purpose of introducing electric lighting, and the beautiful invention of M. Jablochkoff—the electric candle—is the property of this Company. Thanks to their energy, and that of their able Director, M. Denayrouze, the light is to be seen applied under many different conditions—in the streets and open places, in the courtyard of an hotel, in workshops and show-rooms, in public gardens, and the theatre.

In all these places the total light provided is vastly in excess of what was obtained from the gas formerly used, and the effect is naturally so much better. Especially in the streets, we will all agree that more light would not be thrown away, even in London. In some large open spaces, such, for instance, as the Place de l'Opéra, where the lamps must needs be far apart, the electric light has a decided advantage over gas as usually burned, because it more thoroughly illuminates the broad spaces between lamp and lamp. But this is a very small matter, and one that, if raised by the Street Authorities, and accompanied by a proffer to pay for more light, could probably be met by our friend, Mr. Sugg, who would bring out yet another new burner.

Taking, however, the best illustrations afforded of the use of the electric light in places where, for the moment, the gas-burners have been turned off before it, we see how impossible it is for it to do more than touch the fringe of our business. The necessity for using it in centres of great intensity involves also the necessity for fixing these foci at considerable distances apart, and this again that there shall be wasteful expenditure of light at the centre, if there is to be sufficient at the extremity of the field. The law on which photometric observations are based—viz., that the value of a light diminishes as the square of the distance it is removed from the point to be illuminated—explains this clearly. Suppose a room, 100 feet by 20 feet, needing to be lighted to a certain minimum extent, which is met by gas-burners of 16 candles value, lighting a radius of 10 feet, clearly five such burners would fully illuminate the room, and the candle power used would be 80. If the light must needs be given from one centre, and that in the middle of the room, the total would have to be as the square of 50 is to that of 10, or as 25 to 1, giving 400 candles against the 80. But, if this one light is pushed back to the wall of the room, then, in order to get an effect at the opposite end equal to that given by the 16-candle burner, its value must be increased in the proportion of the square of 100 to that of 10, or as 100 to 1. The result of this is that while the light of 80 candles distributed would give the desired amount of light, 1600 candles, concentrated in one spot, at the extremity of the field, would be required to do the same work. The excessive brightness at the point where the light was centred would be so much waste, and an embarrassment rather than an advantage. Bearing this in mind, the electric light is certainly more costly than gaslight.

Take another illustration. I have here a letter from a firm of Engineers in France, who have for some time used electric lamps in their erecting shop, which is 145 feet long by 36 feet wide. There are two lamps used,

giving a light said to equal 3800 candles, and they are fixed at a height of 30 feet from the floor. (Such a position as this, on premises where power is always available when light is wanted, offers the greatest inducement to the adoption of electricity.) The cost, taken from the users figures, is as follows:—

Cost of machines and lamps	£208	0	0
Power required to drive same . Five horses.			
Cost per Year, 500 Hours Burning.			
Interest at 12 per cent. to cover maintenance	25	0	0
Carbon, 9·4 in. × 500 × 6½d.	10	12	0
Coal, 4½ lbs. per horse power, at 21s. per ton .	5	4	0
Supervision, 500 hours at 3·3d.	6	17	6
	£47	13	6

or 22·9d. per hour.

But if we add to this what my correspondents have left out, because they had not specially to provide it—viz., cost of engine, boiler, setting and chimney, say £200 for the 5-horse power-engine, 10 per cent. on for maintenance and interest, adds £20 to the annual charge, making it £67 13s. 6d., or 32·5d. per hour.

I will assume the greatest amount of light to be required at a height of 4 feet from the floor, that 60 6-feet burners are distributed along the shop in 6 rings of 10 each, at a height of 12 feet. These would give out a light equal to 960 candles. The cost of this would be—

60 × 6 × 500 = 180,000 cubic feet of gas, at 3s. 4d. . .	£30 0 0
Interest on fittings, £30 at 10 per cent.	3 0 0
Total	£33 0 0

or £14 13s. 6d. per annum less than electricity. But such a gaslight would be regarded as extravagant to a degree. It would be equal, at the point I have specified—4 feet from the floor—to more than twice that of the electric light, if we regard light alone, and allow nothing for the superior diffusion of the light from many gas-burners. The equation would be—

$$8^2 : 26^2 :: 960 : 10{,}140;$$

while the lamps only gave 3800. Thus twice the useful light would be had for half the cost. Remember also that this comparison is between gas which has paid its manufacturers full dividends, and the cost price of the electric light with no charge upon it even for distribution.

In this case the electric current was used in the most economical manner—viz., the whole strength of a machine concentrated on one light.

I am unable to furnish any exact figures as to the cost of lighting, by the system of M. Jablochkoff, with lights of less power; but it is certainly, light for light, largely in excess of the direct one. The division of the current, I am assured, involves both increased power and diminished light, and the carbons also are much more expensive. As an instance, I saw a room, about 80 feet by 60 feet, which had been satisfactorily lighted by 48 gas-burners using about 5 feet per hour. In one night of six hours these would consume 48 × 5 × 6 = 1440 cubic feet, which, at 3s. 6d. per 1000, would be equal to 5s. The gas had been displaced by 8 electric lights, in which the "candles" were changed every hour, and each cost, I was informed, 5½d. A night of six hours in this case would, therefore, cost, for carbons only—

$$8 \times 6 = 48 \times 5\tfrac{1}{2}\text{d.} = £1\ 2\text{s.}$$

Thus the carbons alone were costing (if I was rightly informed as to their price) more than four times the total cost of the gas. Add to this, interest on cost of machinery, cost of some 10-horse power absorbed in generating, payment of stoker and "gas man" in attendance, and it does not need royalty charges and shareholders profit to make the electric light a very costly luxury.

So much for the commercial aspect of the question. But I do not hesitate to say that if the figures had all been the reverse of what I have given you, I should entertain no fear as to the competition of the electric light for the following among many reasons:—

1. The impossibility of reducing it to a power generally useful.
2. That it does not admit of regulation.
3. It is so variable and uncertain that no space can be left wholly to the illumination of one lamp.
4. Its colour is more trying and wearying to the eyes.
5. The light must always require periodical attention on the part of the consumers.

In fact, so far as adaptation to the purposes of general, and especially of domestic, illumination goes, it appears to me that all the graver difficulties are as unconquered now as they were 20 years ago.

There is one aspect of the comparison between lighting by gas and by electricity which is worthy of remark, as explaining the magnitude of the plant that would be required by the latter. The electric light cannot be stored; consequently, the plant must be equal to producing the maximum amount required at the moment when it is wanted. A Gas Company with a capital of £1,000,000 are able to supply 1,000,000 cubic feet per hour at the time of greatest consumption. This is equal to a light of 3,200,000 sperm candles. I am safe in assuming that 1-horse power would not be equal to producing an electric light of more than 400 available candles. Now, dividing 400 into 3,200,000, we have 8000 as the equivalent in horse power of 1,000,000 cubic feet of gas. This power would need to be broken up into many sections, and would not cost for engines, boilers, houses, shafting, and machines, less than £80 per horse power; consequently, the 8000-horse power would cost £640,000. But then I have shown that, as compared with gas, not one-fourth of the effect of the electric light is actually obtained; consequently, because of the disadvantageous circumstances under which it is burned, at least four times as much must be provided. If the £640,000 is multiplied by four, we have £2,560,000 as the cost of producing plant alone, exclusive of distribution, against £1,000,000 for gas, including all, and that estimate is not at all surprising, judged by the illustrations we have had opportunity of examining hitherto.

If I have occupied too much time by these remarks, I beg you to excuse me; I had no intention of dwelling so long on the subject when I commenced.

And now let me, in conclusion, say a few words suggested by the recent scare as to what, in my humble opinion, should be the future policy of Gas Companies.

Nothing has come more prominently to the front in the discussions which have taken place than the wonderful adaptability of gas to the various requirements of artificial illumination. We supply a light which is cheap, safe, pleasant, and unfailing, whether as a diminutive night-light or a brilliant glare. But further, with the same material, we can cook the delicate omelette to perfection, and the dinner for the million with economy. Gas, too, is a cheap and convenient motor, whether for driving a hairbrush, an electrical machine, or, to venture upon prophecy, a tramway car. It is also capable, without causing dirt or needing attention, of warming our houses in situations where otherwise warmth would be difficult or impossible of attainment. Then again we are manufacturers of other products which are the bases of important industries. The salts we produce are of such fertilizing power that they cause the desert to rejoice and blossom; while from another residual, among uses of a more prosaic but still profitable character, we are able to lend to beauty the glories of the rainbow. But it is not necessary that I should dilate upon the variety of our resources; suffice it to say, that we are alive to the fact, that every material formerly regarded as obnoxious is only so much matter out of place, and which may eventually be developed into an element of profit.

Now the question I would ask is the same in effect as that which was put with so much power and weighty argument by Mr. Bennett last year. Have we done full justice to this great inheritance? I do not think we have much need to be ashamed of the past, but we have certainly a large field before us which will amply repay the cultivation of it. We congratulate Mr. Warner that the step he initiated last year, and which was described by one Past-President (Mr. Spice) in language of glowing approval, has borne fruit beyond the limits of South Shields. Stockton has had an exhibition of gas apparatus and products of the gas manufacture, which "won golden opinions from all sorts of people;" and more recently Birmingham has opened its Town Hall to the reception and exhibition of such a collection of apparatus for the economical and convenient use of gas in its multifarious applications, as has never before been attempted. These exhibitions have been accompanied by what is of vital consequence to their use—viz., full information as to the *cost* at which the work shown is accomplished. These exhibitions are important strides in the right direction. What is wanted now is that they shall become, at least in all large towns, universal, and that they shall be *permanent*.

I commend to the attentive observation of all who visit Paris, the means adopted by the Paris Gas Company to educate the public in this way, both as to the use of gas and coke. I hope we may soon see similar establishments opened here, where consumers will be able to ascertain how best to use the commodity with which we supply them; for in this way a reproach will be lifted from us, and a great service rendered to the public.

Our true interest lies in so conducting our business that our position as monopolists is lost sight of. We should proceed upon the lines indicated by the successful tradesmen in active competition, who are ever ready to press the question, "Is there anything more that we can do for you?"

I have previously touched upon the relation which the charges due to excessive expenditure of capital bear to the selling price of gas. Permit me to point out what a reserve of security and usefulness we at present possess in this direction. We are all aware that gas-works must be planned and laid down, not relatively to the annual sale, but to the greatest day demand; and our calculations would be imperfect if we failed to take into consideration the maximum hourly consumption; for mains which would be competent to distribute a day's make over six hours, would manifestly prove inadequate to pass the same quantity in five. But the shortened hours of labour of late years have limited the maximum rate of consumption in many towns, I am told, to little over two hours. Our plant, therefore, must be large enough to meet the strain of a few hours demand which is greatly in excess of that of the rest of the day, and, in summer time, some 70 per cent. of it may be said to be idle.

Now let me suppose a town where the selling price of gas is 3s. 6d., and the charge for dividend on capital, 1s.; we have thus 2s. 6d. per 1000 cubic feet as the cost of gas at the consumer's meter. Out of the 2s. 6d., it is reasonable to suppose that leakage, distribution charges, rates, and management will cost at least 8d. per 1000. Now the actual expenditure under all these heads would be practically the same if the sale of gas were doubled by a day consumption. I assume that distributing plant, including gasholders, represents one-half the capital account, and, consequently, one-half of the 1s. required for dividend. We have then 6d. for interest, and charges amounting to 8d., in all 14d. as costs not dependent upon annual consumption. Now, assume that the public have been made alive to the undoubted economy of gas for cooking, warming, &c., and that the consumption is thereby doubled by a day demand, clearly the 14d., which I have named, would, in that case, be divided by two, and gas could be sold for 7d. less, or 2s. 11d. against 3s. 6d. per 1000 cubic feet. Many Managers are fully alive to these considerations, and, I think, they are destined to have increasing weight. Let us here, in our Association, and at home in our individual spheres, lend our earnest attention to still further improving the quality, and cheapening the price of gas. Let us also educate our consumers into the proper use of it, and the future of our industry will be at least as bright as its immediate past.

Gentlemen, I have trespassed too long on your patience, accept my thanks for the kindness with which you have listened to me.

The PRESIDENT then announced the award of premiums for papers read last year, as follows:—No. 1, Mr. C. Woodall; No. 2, Mr. R. O. Patterson; No. 3, Mr. W. H. Bennett; No. 4, Mr. W. Sugg. He also stated the arrangements which had been made for the excursion to Hampton and to Paris, where, he said, French friends had made every effort to ensure a pleasant and interesting visit.

Messrs. Hartley and Darwin were appointed scrutineers of the ballot papers for the election of the Officers and Committee of the Association for the ensuing year.

READING OF PAPERS.

The reading of papers was then proceeded with. They are here enumerated in the order in which they were read, and we reserve their publication, and our report of the discussions thereon, as usual, for succeeding numbers.

The first paper, prepared by Mr. Richards, was read by Mr. F. W. HARTLEY, in the absence of the author. The subject was "Brick, Concrete, and Composite Tanks."

Mr. A. PENNY, of London, read a paper on the "Transfer of Gas-Works."

Mr. G. LIVESEY, of London, read a paper on "Capital and Revenue."

Mr. C. HUNT, of Birmingham, read a paper on "Preventible Waste."

Mr. J. METHVEN, of London, read a paper on "A New Standard for Determining the Illuminating Power of Gas."

In the evening a lecture was delivered before the members by Mr. THOMAS WILLS, F.C.S., on "The Products of Combustion."

WEDNESDAY, JUNE 19.

The PRESIDENT took the chair at ten o'clock, and the reading of papers was resumed.

Mr. T. TRAVERS, of Cork, read a paper on "Some of the Causes tending to Retard the Application of Gas for Heating Purposes."

Mr. F. D. MARSHALL, of Brentford, read a paper on "The Purification of Gas by Liquids."

Mr. F. LIVESEY, of London, read a paper on "Some Experiments with Ammoniacal Liquor as a Purifying Agent."

Mr. G. E. DAVIS, of Manchester, read a paper on "The Correct Method of Analysis, and the Correct Valuation of Residual Products."

Mr. G. E. STEVENSON, of Peterborough, read a paper entitled "Some Notes on the Construction of Retort Settings."

Mr. S. LEONI, of London, read a paper on "Cooking by Gas."

Mr. W. T. CARPENTER, of Sheerness, read a paper on "Improvements in Carbonizing Apparatus."

ELECTION OF HONORARY MEMBERS.

The PRESIDENT then proposed that the Association should elect as Honorary Members the President and Past Presidents of the Société Technique de l'Industrie du Gaz en France. This, he said, would only be reciprocating a courtesy which their sister Society in France had already paid them, and the Committee, therefore, unanimously recommended that they should be elected.

This was unanimously agreed to.

The PRESIDENT said they were very glad to welcome amongst them at that meeting three members of the profession from the other side of the Atlantic. He understood, from gentlemen who had visited America, that they were received by their brethren there with the greatest kindness, and every effort to make their visit pleasant and profitable. He had, therefore, to propose, as an expression of the pleasure they felt in seeing these gentlemen amongst them, that they should elect Captain G. Warren Dresser, the Editor of the *American Gaslight Journal*, who had long occupied a prominent position amongst gas men in America, as an Honorary Member of the Association.

The resolution having been carried unanimously,

Captain DRESSER said this honour was entirely unexpected, and he could not take it as addressed to himself in the slightest degree. He understood that the spirit in which it was given was not in honour of him as an individual, but his countrymen. Some of them had come over to see if they could learn something in the mother country, and they would be extremely delighted to go back and tell their brethren with what kindness, honour, and distinction they had been received.

ELECTION OF COMMITTEE AND OFFICERS.

The SECRETARY read the report of the Scrutineers as to the result of their examination of the ballot papers, from which it appeared that the following gentlemen had been elected for the ensuing year:—

President.—Mr. W. J. Warner.
Vice-Presidents.—Mr. J. Douglas, Mr. C. Hunt, and Mr. G. W. Stevenson.
Treasurer.—Mr. H. Newall.
Secretary.—Mr. W. H. Bennett.
Committee (new members to replace those going off by rotation).—Mr. J. Braddock, Mr. W. Carr, and Mr. R. H. Jones.
Finance Committee.—Mr. G. Livesey, Mr. J. Eldridge, Mr. G. W. Stevenson.
Auditors.—Mr. A. Hersee and Mr. A. Lass.

REPORT OF COMMITTEE.

The SECRETARY read the following report:—

"Obedient to the instruction of the last general meeting, your Committee have considered the proposition made by Mr. Travers—that the bounds of the Association should be enlarged so as to admit Water Engineers to membership.

"Your Committee fully recognize the fact that to a certain number of the Members, who associate the duties of Gas and Water Managers, there would be an advantage in the change proposed, and that to such, papers and discussions on water-works topics would be interesting and profitable. They feel, however, on the other hand, that the change proposed would be a radical alteration in the character of the Association, which circumstances do not call for, and which, in its effect, is more likely to produce embarrassment than advantage. Desirable as it may be to add to the number of our members, it is of still more consequence that the proceedings of the meetings should interest and help those who attend them. Your Committee are of opinion that the consideration of gas matters would not prove attractive to gentlemen whose business was confined to water-works, and *vice versâ*. A consequence would probably be that members would, to a greater extent than at present, absent themselves during a portion of the proceedings. Your Committee are, therefore, of opinion that it would not be beneficial to the Association to make the alteration proposed.

"Your Committee desire to call the attention of members to two other matters—

"*The Financial Position of our Association.*

"On this point they cannot do better than adopt, as their own, the following passage from a report to them of the Finance Committee, dated March 28, 1878, which is as follows:—'Your Committee have given their attention to the financial state of the Association, and they find that the recommendation contained in their report of last year, that the members should be informed that a slight increase in the subscriptions was necessary, in order to make the income superior to the expenditure, has met their expectations, and that there is a balance of about £15, on the year 1877, in favour of the Association. Although your Committee do not consider it desirable that there should be any considerable annual increase in the balance carried forward, they are of opinion that provision should be made to prevent occasional deficits in future. Your Committee recommend that, in future, arrears of subscriptions should appear in the accounts of the year as an asset, and that subscriptions remaining unpaid at the end of the second year should be written off. In order to reduce the arrears as much as possible, your Committee recommend that the Secretary be instructed not to forward the copy of the transactions to any member until his subscription for the current year has been paid. The accounts will then be so clear and simple that it will be impossible to deduce erroneous conclusions from them.'

"Your Committee, not prepared to advise the abolition of premiums, have decided to add to these recommendations of the Finance Committee this further one—that the subscription of all members elected in future be fixed at a guinea, and not left optional, as at present.

"The second matter which has engaged the Committee's attention, and on which they now report, is

"*The Nomination of Members of the Committee.*

"This was the subject of some discussion at the Bristol Meeting, ending in a resolution confirming the present rule. Your Committee felt, however, that although it was very undesirable to make alterations in the rules at a general meeting without notice, and where it was impossible to spare sufficient time for the proper consideration of the proposal made, yet it was their duty to give attention to any suggestion made at the meeting.

"The Committee have had the advantage of suggestions from several members since the discussion took place, and they now submit the following plan for consideration, which has been designed to meet the views of those members who think the Committee are not sufficiently representative of the whole body:—

"'It shall be open to any member to propose another as a member of Committee. If the proposal is duly made, and supported by the names of two other members, and sent to the Secretary on or before the 31st of March preceding the annual meeting, the Committee shall accept the nomination, and include the name of the gentleman so proposed in the voting list. No member shall propose or support the nomination of more than one member of Committee in the same year.

"'Further, the number of names to be nominated by the Committee shall be reduced from twelve, as at present, to six; but in the event of there not being six names nominated by other members, the Committee shall fill up the number to twelve, as required by the rule. The Committee recommend that Rule 30 be altered in accordance with this suggestion.'"

The PRESIDENT moved that the report be received, which having been carried, he invited discussion upon it. He said if there were no remarks to be made upon it, he would ask some member of the Committee to move its adoption. He might say, however, that the Committee had looked very carefully into the matter, and they felt that the suggestions made at the last meeting had considerable force in them, that the election of members of the Committee should be made as fully representative as possible, and that therefore it was advisable to widen the constituency proposing them in this way. Now that the rule was proposed to be altered, he could only express his hope that members would avail themselves of it, and that it would not be left to the Committee to nominate the whole number, though he should not be much surprised if such proved to be the case.

Mr. WEST (Maidstone) moved the adoption of the report.

Mr. HEPWORTH (Carlisle) seconded it.

Mr. CARR (Halifax) said there was a remark in the report to which he objected—namely, where it stated it was hoped it would meet the views of gentlemen who did not think the Committee were sufficiently representative. He, himself, did not know who were the people who held that opinion; and he was present during the whole of the discussion twelve months ago, and took part in it, and he did not remember any one making the charge that the Committee were not sufficiently representative. The only objection taken to the rule was that the nomination placed the Committee in rather an unfortunate position, and it was with a view to remove the possibility of any members saying that they were not represented by the Committee that this was proposed. He was much pleased that the Committee had taken the matter in hand and dealt with it in the way they had. He believed they had given the matter their best consideration; and the plan they proposed was, no doubt, the best, under the circumstances. They had shown, not only their representative character, but their desire to push the best interests of the Association, and he believed now it would be utterly impossible for any section of the Association to say they were unfairly represented. They must always go by the majority of members, and they would have the opportunity of trying their strength at any time they felt disposed.

Mr. STONE (Weymouth) said one part of the report seemed rather hard—namely, that which would compel new members to subscribe one guinea. He feared this would deter many managers of small gas-works from joining, because it would be a great burden to many men in such a position, who were really those most requiring the privileges of the Association. There were a great many members of the Association at present who would not feel it a hardship to subscribe one guinea, if necessary; but many did not think it necessary to do so at all. The expenditure of the Association had for several years been increasing to what some thought an alarming extent. Many years ago the funds of the Association improved until they got to something like £400 in hand, but for two or three years past they had been gradually diminishing. Thus it happened, unfortunately, that the richer they got the poorer they were. The question was whether they should meet that position by increasing the subscriptions or diminishing the expenditure, and he should rather advocate the latter.

The PRESIDENT said, as the remarks of the last speaker seemed to be received with favour by the meeting, he should be glad if those who were of the same opinion would express it.

Mr. JONES (Chesterfield) said he took part in this discussion somewhat reluctantly. He thought that the change shadowed forth in the report now presented was of such serious importance that they ought to have more time for its consideration. With reference to the introduction of Managers of water-works, he regretted that the Committee could not see their way to advise the Association to try the experiment. Representing as he did a Water and Gas Company with a capital of £300,000, he did not think his position as a Gas Manager was at all disparaged by being associated with the Water Department. He should like to see their brethren in the water line associated with themselves, as there were many points in common which might be dealt with by the Association to the advantage of both Water and Gas Engineers. The point, however, to which he wished more particularly to allude was the rate of subscription, and he agreed with his friend, Mr. Stone, that it was highly desirable for that portion of the report to be re-considered. In times like the present, they could not expect men who were managing small gas-works to be throwing away a guinea for one meeting a year, and there were many things in which the expenses might be curtailed. For instance, he found the secretarial expenses of the North of England Institution of Mining and Mechanical Engineers averaged 21¼ per cent. of the income, and they had five meetings a year. The Chesterfield and Derbyshire Institute of Engineers, of which he had the honour to be a Councillor, averaged a smaller per centage for secretarial expenses, and they had five meetings a year, and their transactions were most elaborately got up. The Secretary of this Association, however, received more than 36 per cent. of the income, for one meeting a year. He was quite satisfied that the Finance Committee could see their way, if they would, to diminish the expenditure, instead of raising the subscription. They were paying the Secretary excessively, and most excessively for office rent. The office rent was £40 a year. The Secretary £140, and there was a further charge of £9 8s. 9d. for travelling expenses of the Committee. Time was when the gentlemen who served on the Committee were content to sacrifice their time.

The PRESIDENT, interposing, remarked that, while he hoped all members who wished would express their opinion on this point, he must ask them to bear in mind the lateness of the hour, and the short time in which they had to get through the business.

Mr. JONES said he regretted exceedingly, as he was in order in discussing the financial position of the Association, that he was not allowed to proceed.

The PRESIDENT said he had not the least desire to ask Mr. Jones to conclude his remarks at once; he only wished to point out to him that he had already occupied a considerable time.

Mr. THORNELOE suggested that it would be as well for the Secretary to retire while this discusion took place.

[The Secretary expressed his perfect willingness to do so. The members generally, however, seemed to express dissent.]

Mr. JONES said he did not wish to take up time unnecessarily, and he would, therefore, simply move that the report, as presented, be ordered to lie on the table, so that members might have time to consider it.

Mr. MEAD (Sutton) was anxious the members of the Association should always continue to act as harmoniously together as they had in times past. It might be in the recollection of Mr. Jones and others, that the Secretary's salary had been increased by themselves without any application from him; and, under those circumstances, it would be most ungracious now to find fault with the amount he received. That they had an excellent Secretary, no one could doubt, nor that they would have great difficulty in finding another who could do the same work so well as

he had done it. He (Mr. Mead) trusted, therefore, that, whatever their opinion might be, they would not think of withdrawing any part of the salary they themselves had voted. As to the question of subscription, he could not conceive that any Gas Manager could consider that 21s. a year was too much to pay for the privilege of attending these meetings. He had had a great many years experience of gas matters, but he had never attended a meeting without going away the better for it.

Mr. BARRATT (Grantham) said he knew there was a wide dissatisfaction on the part of many members as to the financial position of the Association, and the manner in which the business had been conducted. He, therefore, had great pleasure in seconding Mr. Jones's amendment, in order that the question might be properly ventilated. He was not satisfied with their financial position, and thought that the expenditure was considerably more than it ought to be. It would be a serious infliction on many good men who wished to join the Association if the subscription were raised as proposed. There were no men better able to judge what a man was worth than Gas Engineers; for it was part of their constant duty to calculate minutely the expenditure in every department, and if there were any excess anywhere, to put their finger upon it and have it altered. He hoped, therefore, the subject would be discussed calmly and dispassionately; but he could not help saying that he was not satisfied with the manner in which the secretarial duties were performed.

Mr. GEORGE LIVESEY thought the discussion was taking a course which would be anything but beneficial to the Association, as it seemed becoming a personal question. He would also point out that there were many other matters in the report besides the one to which attention was now drawn, and which it was important should be settled, and settled at once. Then he would also ask, in reference to the Secretary, whether the members, any of them, were in a position to know what the duties performed by that officer were. One only knew what a man was worth when one knew what he did. Having himself been connected with the Association officially for something like ten years, and having, perhaps, seen as much of the work done by the Secretary as any one, he considered the salary received was anything but too large. They had in Mr. Bennett a man who devoted himself heartily to the interests of the Association, who was always thinking how he could best promote those interests, and to bring up this question in the way it had been done, after Mr. Bennett had served the Association well all these years, was anything but praiseworthy on the part of any members. Nor was there any necessity for it. The whole question had arisen upon the subject of raising the subscription from a half to one guinea. As a member of the Finance Committee, he fully accepted the responsibility of that recommendation, but he did not insist that it was essential to the prosperity of the Association. He had gone into the accounts carefully, and he found that, with the exception of one single year, the expenditure had always been less than the income. The accounts had certainly been published in a form which did not clearly express the exact position of the Association; and the Finance Committee, in order to avoid arrears in the future, made the recommendation in the report. Last year the income was about £30 above the expenditure. It was not necessary, therefore, to increase the subscription, though he thought it was advisable. He thought 10s. 6d. was too low; and, besides, he thought the subscription ought to be paid by the Companies or Corporations, and that, if the matter were properly brought before them, they would do so. The point before the meeting was, therefore, whether they should have an increased subscription for future members. The existing members would go on paying the same, if they chose, and there would be no pressure put upon them to pay more. He thought this matter might be put to the vote, and then the other points in the report could be taken on their merits. As to reducing the Secretary's salary, he was quite certain the members generally would not listen to it for a moment.

The PRESIDENT asked if Mr. Jones would be willing to withdraw his amendment in order to put the question suggested by Mr. Livesey.

Mr. JONES had no objection personally to the course suggested, but he should like to take the opinion of his brethren before consenting.

The PRESIDENT said he could not allow another speech.

Mr. JONES said in that case he must decline to withdraw the amendment.

Mr. SMITH (Darlington) thought that, according to Mr. Livesey's own view, there was no necessity for raising the subscription, for it appeared that in every year but one their assets had been in excess of the liabilities. If, as Mr. Livesey suggested, Gas Companies or Corporations paid the subscriptions for their Managers, it would be then time enough to increase the subscription; but until such was the case he thought the Committee had scarcely any ground for making such a recommendation.

The PRESIDENT said he should have preferred to put the report paragraph by paragraph, but as Mr. Jones's amendment was not withdrawn he was obliged to put it.

Mr. IRONS (Gosport) suggested that the mover of the original resolution should consent to its being altered so far as regarded the paragraph referring to the subscription. They ought to consider the persons who formed the Association, and who fixed the rate of subscription at 10s. 6d. In early times they were much indebted to two eminent men, the late Mr. Barlow and Mr. Hawksley. He remembered Mr. Hawksley being in the chair as President when a similar question was brought forward, and he strongly advised that while the subscription might be increased to one guinea for those who were willing to pay it, it ought not to be increased compulsorily. The objection that many felt to the paragraph in the report was that it would make an increase compulsory for future members, and as there was no real necessity, he asked the Committee to withdraw that part, so that the meeting might adopt the rest, which was very serviceable.

The PRESIDENT entirely agreed with Mr. Irons's remarks, but he had no option but to put the amendment.

The amendment was then put, and lost by a large majority.

Mr. GEORGE LIVESEY proposed another amendment, to the effect that the paragraph relating to the increase of subscriptions be expunged.

Mr. CARR seconded this amendment, which, on being put to the meeting, was carried almost unanimously.

The PRESIDENT, in putting the original motion, with the paragraph relating to increased rate of subscription expunged, said it would be hardly necessary to discuss it further, after what had taken place; but he would remind the members that it was the outcome largely of the discussion which took place at the Bristol meeting, where it was argued that it was impossible to discuss the proposal then made, and it was therefore negatived. The Committee, however, felt it their duty carefully to consider whether the meeting had been acting rightly in negativing the proposal, and in the interval they had most carefully considered the suggestions made. The members need not be under any apprehension, therefore, that, in adopting the report, they were doing things hastily or inconsiderately.

The motion was put, and carried *nem. con.*

MEMBERS IN ARREARS.

The SECRETARY then read the list of those whose subscriptions having been in arrear for two years, had *ipso facto* ceased to be members.

TIME AND PLACE OF NEXT MEETING.

The PRESIDENT said the next business was to choose a place of meeting for next year.

Glasgow, Newcastle-on-Tyne, Portsmouth, and Sheffield were all proposed by various gentlemen, but Portsmouth was afterwards withdrawn. During the conversation which took place,

Mr. HUNTER (Salford) suggested that in future it would be well if some formal invitation was sent up from provincial towns, because it was very easy for gentlemen to get up and propose a certain place of meeting, without having taken any means to ascertain whether a visit would be locally acceptable.

Mr. HEPWORTH (Carlisle) said the North of England Association had considered this matter, and, though they had not sent a formal application, they were unanimously of opinion that it would be the greatest pleasure the Association could confer upon them if they would meet next year in Newcastle-on-Tyne.

On a vote being taken, the meeting decided by a very large majority in favour of Newcastle.

VOTES OF THANKS.

The PRESIDENT then moved a cordial vote of thanks to the gentlemen who had contributed papers. He said he was hardly in a position to express a fair opinion as to the character of this meeting, as compared with others; but, personally, he thought it had been very successful, for he felt sure that a better set of papers they had never had. The attention with which they had been listened to, and the large attendance while they were being read, had been the best testimony as to their character. He would, of course, include in the vote those gentlemen who had prepared papers which, for want of time, had not been read.

The resolution was put, and carried unanimously.

Mr. WARNER said he felt very deeply the high honour conferred upon him in electing him as President for the coming year, and he was quite sure that the people in Newcastle-on-Tyne would equally feel it their duty, as he felt it his, to advance the interests of the Association, and to maintain its high honour.

Mr. OHREN moved a vote of thanks to the Committee for the manner in which they had carried out their duties during the past year, and for the report which had been adopted.

The motion was carried unanimously.

Mr. HENRY WOODALL moved a vote of thanks to the Treasurer, Mr. Newall, whose operations, he said, reminded him of the laws of nature; they were always constant, though never seen.

The resolution having been carried unanimously,

Mr. STORER moved a vote of thanks to the Scrutineers, Mr. Hartley and Mr. Darwin.

This resolution was also carried unanimously.

Mr. HEPWORTH moved a vote of thanks to the Society of Arts, whose hospitality they had always experienced when coming to London, and to Mr. Le Neve Foster, the Secretary. He never came to that room without thinking also of the indirect aid which the Society of Arts had given to their Association, by the publication of some very valuable lectures on subjects connected with their operations.

The resolution was carried unanimously.

Mr. GEORGE LIVESEY said he was called upon to perform an act of justice, which the Society had for some time neglected. In former years the Association were accustomed to pass a vote of thanks to the late Mr. Barlow for taking notes of the meeting, and furnishing them to the Society, thus contributing very largely to their income, and diminishing their expenses. That kindness had been continued by his successor, Mr. King; and he hoped Mr. King would not feel it had been a slight on the part of the Association that they had never acknowledged his kindness. It had been generally understood by the members that Mr. King had done this voluntarily and generously, though, somehow or other, they had omitted to pay a formal acknowledgment of the services thus rendered. It was their bounden duty to express their hearty thanks to Mr. King for his great generosity, without which the Association would have found before this that the half-guinea subscription was insufficient to meet their expenses.

The PRESIDENT, in putting the motion, said as there had been an omission before, he hoped the members would, if possible throw the fervour of half-a-dozen years into the vote of one. They all felt such personal regard and friendship for Mr. King, and such an interest in the work he was doing, that it was always very pleasant to them to see him among them.

The resolution having been carried unanimously,

Mr. KING acknowledged the vote, and thanked the meeting for the very cordial manner in which it had been adopted. His predecessor in the conduct of the JOURNAL, the late Mr. Barlow, had always manifested great interest in the prosperity of the Association, and he had himself been influenced by the same spirit. It had been his happiness to attend every meeting of the Association since the first gathering in Manchester, in 1863, and he had personally reported the proceedings each year until now that the state of his health prevented him from undertaking the labour. He was glad, however, to be present on this occasion, and, with the aid of his friend at his side, to continue his work. Any assistance he had rendered to the Association had been rendered with much satisfaction to himself.

Mr. MORTON proposed a vote of thanks to the President. He wished some one better fitted to speak of him had been chosen, although no one knew better than he the high qualities of Mr. Corbet Woodall. He had been intimately associated with him throughout his professional career, and had seen with much pleasure the progress he had made therein. He therefore proposed a cordial vote of thanks to Mr. Woodall for his conduct in the chair, for the onerous work he had done for the Association during the year, and especially during the past month, and for the admirable Address with which he opened the meeting.

The resolution having been carried by acclamation,

The PRESIDENT thanked the meeting for the kindness with which they had received Mr. Morton's remarks. He could only say there were few things more satisfactory than to hear, as he had heard, for the first time, that Mr. Morton's acquaintance with him for a term of years had not diminished the regard with which it commenced. He could only say, with reference to the proceedings of the last two days, that they had been to him a source of continued satisfaction and pleasure. He commenced his duties with considerable misgivings, but his apprehensions vanished almost from the first moment of taking the chair, and the confidence he experienced in the cordial support he should receive from the members had been more than fully realized. Before sitting down, he wished to propose a vote of thanks to the Secretary. He was particularly glad of the opportunity of being able to say a word or two with reference to that gentleman. He had no idea, until the commencement of his year of office, what the amount of attention and labour was that devolved on the Secretary of the Association. He could assure the meeting most emphatically, that if those duties were rendered in return for the emolument received, he should regard the remuneration given as utterly inadequate to the services performed. Furthermore, he did not believe that those services were rendered for the sake of the emolument, but they

were done by Mr. Bennett with a hearty and loving service, which was of great value to the Association.

The resolution having been carried unanimously,

The SECRETARY briefly and appropriately thanked the members for their kindness.

This being the whole of the general business, the meeting was brought to a close.

THURSDAY, JUNE 20.

At eleven o'clock this morning the members assembled at the Phœnix Gas Company's gasholder-station in Kennington Lane, to witness the progress made in the construction of the largest gasholder at present in existence. Here they were met by Mr. Shand, the Deputy-Chairman of the Company, from whom they received a very hearty welcome, which was cordially acknowledged on their behalf by Mr. Warner, the President of the Association for the coming year. Mr. Woodall, the Engineer of the Company and present President, furnished the visitors with every desired information respecting his large and important work, to which, however, it is here unnecessary to refer, as the drawings and details are in course of publication in the JOURNAL. After spending two hours at the works, partly in doing justice to a choice refection provided for them by the Phœnix Gas Company, the members proceeded to the Vauxhall station of the South-Western Railway, whence they were conveyed to Hampton by train. Here an inspection of the works of the Grand Junction and Southwark and Vauxhall Water Companies reservoirs, engines, &c., took place, and an adjournment to Bushey Park followed, where, after partaking of an elegantly-appointed luncheon, the remainder of the day was spent in viewing the Great Hall, Picture Galleries, and grounds of Hampton Court Palace, the company returning to London about eight o'clock in the evening.

On Friday, June 21, those of the members who intended to visit the Paris Exhibition started from the Victoria Railway Station at 7·40 a.m. for Dover, whence they proceeded, *viâ* Calais, for the French capital.

We have been favoured by correspondents with narratives of the engagements of the following days.

On Saturday morning, at ten o'clock, the members visited the Exhibition, where they were met by MM. Arson, Servier, Ellissen, and several other gentlemen, in the Pavillon de la Compagnie Parisienne du Gaz, who explained to them the interesting exhibits of that Company, including elaborate models and drawings of their apparatus, drawings of the brick-works and tar and ammonia plant, samples of products, stoves for heating and cooking by gas and coke, gas-engines, main-pipes, and the method of attaching services, &c. This visit was altogether of great interest, and the members were much impressed by the thoroughness with which the Paris Gas Company had carried out their exhibition.

In the evening, by the invitation of M. Denayrouze, through Mr. Woodall, about 100 of the party assembled at the works of the Electric Light Company, in the Avenue de Villars, and received from M. Jablochkoff and his assistants a very interesting explanation of the apparatus employed in electric lighting as now used in Paris. Afterwards, by the courtesy of the Electric Light Company, the whole party was invited to the concert in the Orangery of the Tuileries Gardens, where they saw the orchestra and grounds illuminated by 48 electric lamps.

On Monday the Paris Gas Company received the members of the British Association at their works at La Villette. Every care was taken by the officers of the Company to explain what was new or strange to the visitors, and the latter expressed very generally admiration of the care taken by the Company to utilize every source of profit open to them. The tar, ammonia, brick retort, and patent fuel works were all in turn examined, and note-books were in constant requisition. After this inspection the Members of the British Association drove to the gas-works at Ivry, where they were met by the Members of the Société Technique de l'Industrie du Gaz en France. A beautiful luncheon had been provided by the Paris Gas Company for the whole party, numbering about 250, in one of the retort-houses, which had been very prettily decorated for the purpose. After the luncheon, and a hearty acknowledgment of the Company's kindness, an inspection of the Siemens furnaces in use for heating the retorts concluded the visit. In the evening a banquet was held by the Société Technique, on the island of the Great Lake in the Bois de Boulogne, to which the President and Committee of the Association were invited. About 60 ordinary members also joined the party. The proceedings of this evening will long remain in the recollection of those who took part in them. The lovely scenery, charming music, and hearty welcome were alike fully appreciated. The health of the British people, and especially the Association of Gas Managers, was cordially drunk, and the reply of the President (Mr. Woodall) was received with hearty applause. The toast of the Société Technique and the French people was proposed by Mr. Woodall in terms which secured enthusiastic concurrence, and the most delightful concord prevailed throughout.

The proceedings of the Société Technique on Tuesday were attended by a large number of the English visitors, who took some part in the discussions carried on.

On Thursday morning a large proportion of the party returned to London, but many remained to see the National Fête on Sunday last. All alike have heartily expressed their satisfaction with the visit, and the arrangements made for their reception and entertainment.

THE REGISTRAR-GENERAL ON THE WATER AND GAS SUPPLY OF LONDON.

In his Annual Report for 1877 the Registrar-General states that, "during the year, the several Water Companies of London realized a gross revenue of £1,246,866, including £1,232,988 by water-rents, of which £492,251 went in working expenses, and £754,615 in the profits of capital. The net profit of the existing capital was at the rate of 6·5 per cent.

"London was supplied with gas by the different Companies during the same period at a cost of £2,744,497. The working expenses were £2,460,896; but, in addition to the meter-rents the Companies, got £832,838 from the sale of coke and from other sources, making the gross revenue £3,577,335, and the profit £1,116,439, that being the difference between the working expenses and the gross revenue. The profits of capital were at the rate of 9·8 per cent.

"The capital engaged in the Gas and Water Companies was £23,023,205,* which realized in the year that ended on April 1, 1877, no less than £1,871,054. That was 8·1 per cent. all round. Now, if this amount of capital were required to construct all the works necessary to supply London with the best gas, and pure soft water at high pressure, the capital could probably be raised at 4, or certainly at 3½ per cent. less than is now paid in dividends. If the capital were raised at 4 per cent., £950,126 would be set free; out of which, after the Companies were adequately compensated, there would be a large revenue for many municipal purposes.

"Dr. Frankland reports in detail on the twelve monthly analyses of the waters supplied to the inhabitants of London by the Metropolitan Companies during the year 1877.

"Taking the mean proportion of organic impurity of Thames water as delivered in 1868 at 1000, it will be observed that the quantity of organic impurity in Thames water in 1877 was 907. Some improvement is thus exhibited in this water, owing chiefly to more careful treatment of it by the several Companies before delivery. The water from the Lea, delivered by the New River and East London Companies, was, as usual, much better than that delivered from the Thames, its organic impurity being represented in 1877 by 596. The deep well water supplied by the Kent Company is unaffected by animal and vegetable life. If, for purpose of comparison, the amount of organic elements found in the Kent Company's water be taken as unity, then it will be observed that, on an average, the quantities of organic matters were greatest in the water supplied from the Thames by the Southwark (4·2) and Chelsea (3·9) Companies, after which stand the Grand Junction (3·6), Lambeth (3·6), and West Middlesex (3·4) Companies, then follow the East London (2·6) and New River (2·2) Companies, drawing their supply from the Lea; and the Colne Valley (1·4) and Tottenham (0·5) supplies, from deep wells.

"According to the returns furnished by the several Water Companies in 1877, 534,546 houses in London, on an average, were supplied with 120,864,496 gallons (549,143 cubic mètres, equal to nearly as many tons) of water daily. Of this quantity Dr. Frankland states that 60,862,201 gallons were occasionally much polluted with sewage matters; 52,771,302 gallons were sometimes so polluted, but to a much less degree, while 7,230,993 only were of unexceptionable quality."

* *London Water and Gas Companies.*—Total paid-up capital (including amount received on calls paid in advance), revenue and expenditure of the Metropolitan Gas and Water Companies for the last financial year ended prior to April 1, 1877:—

	Total paid-up Capital (including Calls paid in Advance.)	Total Gross Revenue.	Revenue from Gas, Meter, and Water Rents.	Total Working Expenditure.
Gas Companies . .	£11,371,124 ..	£3,577,335 ..	£2,744,497 ..	£2,460,896
Water Companies. .	11,652,081 ..	1,246,866 ..	1,232,988 ..	492,251

WATER GAS IN AMERICA.

The following communications on this subject have been addressed to the President of the Municipal Gaslight Company of New York:—

Royal College of Chemistry, South Kensington Museum, London, May 16, 1878.

Sir,—In compliance with your request, I have read the reports of Dr. Henry Würtz, dated Jan. 1, 1878, and March 4, 1878, on the composition and properties of the gas of the Municipal Gaslight Company of New York, and also the articles published by Professor Henry Morton, in the *American Gaslight Journal* of March 2 and 16, 1878,* and having been called upon to express my opinion as to the adaptability of this gas for lighting and heating purposes, I have no hesitation in saying that it may be used with safety, both in public buildings and private houses. I should be delighted to substitute this pure and powerful illuminating agent for the gas with which my house in London is at present supplied, although it is used in all the bed-rooms.

(Signed) E. FRANKLAND.

Charles G. Francklyn, Esq.,
President of the Municipal Gaslight Company of New York.

[TRANSLATION.]

Paris, June 12, 1878.

Sir,—I have read with attention and interest the documents concerning the gas of the Municipal Gaslight Company of New York, which you have forwarded to me.

I have acquainted myself with the extensive and exact work which Dr. Henry Würtz has published about the composition and use of the gas. Produced by the decomposition of steam on incandescent carbon, and saturated with very volatile hydrocarbons, obtained from petroleum, the gas possesses an intense illuminating power, a marked smell, a sufficient density. I have been struck with the correctness of the remarks which terminate the report of Dr. H. Würtz, and which, in my opinion, answer the objections formulated by Dr. Henry Morton, inserted in two articles in the *American Gaslight Journal*, published in New York. No doubt the danger of poisoning exists with all gases containing carbonic oxide, and coal gas is not exempt of the latter, as it can contain as much as 12 per cent. of its volume. But I think that the danger, which could only have sad consequences in exceptional cases, and through a sort of fatality, has been exaggerated, and should not be taken into account, considering that gas is used without hesitation for lighting our houses, notwithstanding the very real danger of explosion and fire, no matter what kind of gas and its composition.

Further, the use of water gas has never been prohibited in France, and if the numerous processes which have been indicated for its production have been abandoned, or have received only a restricted application, the cause is principally due to the circumstance that the technical and economical conditions of the production have, up to the present, been very unfavourable.

In manufacturing, under good conditions, a gas remarkable on account of its illuminating power, and of a sufficient smell to reveal its presence, you have realized an important progress. It would appear to me unjust to deprive you of your useful discovery.

(Signed) ADOLPHE WURTZ,
Member of the Institute, Professor at the School of Medicine and the School of Sciences.

To Charles G. Francklyn, Esq.,
President of the Municipal Gaslight Company of New York.

* These reports have been reproduced in the JOURNAL, Vol. XXXI., pp. 21, 722.

THE LANCASHIRE COAL AND IRON TRADES.

(FROM OUR OWN CORRESPONDENT.)

Both the coal and iron trades of this district continue very dull, and there are still no indications of any early improvement in business. Most of the Lancashire collieries have been put on short time, and it is only in exceptional cases where the iron-works are anything like fully employed.

All classes of round coal still move off very slowly, and the prices, which continue extremely low, are regulated more by the position of the seller and the nature of the order, than by any reference to the nominal list rates. The average selling prices may be given about as under:—Best Wigan Arley, 9s. 6d. to 10s. per ton at the pit; second qualities, 7s. 6d. to 8s. 6d.; Pemberton four-feet 7s. to 7s. 6d.; and common round coal, 5s. 3d. to 6s. per ton. Engine classes of fuel, which have been in better demand since the settlement of the strike in the cotton trade, are rather firmer in price, and advances of about 3d. per ton have in some cases been obtained upon the low rates which have recently been ruling in the market. Burgy at the pit mouth is quoted at from 4s. to 5s. per ton, according to quality, and for good ordinary slack 3s. 3d. to 4s. per ton is asked.

Large quantities of coal, which have been sent to Liverpool on speculation, are still lying at that port, both in railway waggons and in flats, and to move these stocks extremely low figures are quoted by needy holders.

There has been a little speculative inquiry for iron for forward delivery, but as buyers are only willing to give the very low remunerative prices ruling in the market, but little business is done. Lancashire makers of pig iron are able to dispose of their present very limited production, and the prices taken for delivery into the Manchester district are about 50s. per ton for No. 3 foundry, and 49s. for No. 4 forge, less 2½ per cent. Outside brands of iron are still pressed in this market at exceedingly low prices, in many cases very considerably below the nominal list rates quoted by makers. Finished iron is without material change, either as regards prices or demand; Lancashire bars delivered into the Manchester district being still quoted at about £6 2s. 6d. per ton.

THE COAL AND GENERAL TRADE OF THE NORTH OF ENGLAND.

(FROM OUR OWN CORRESPONDENT.)

Last week was Newcastle races, and many of the collieries in Tyneside were off two or three days. More work was done, however, at the collieries than might have been expected. There were no delays in shipments of any sorts of coals. Indeed, they were immediate. Under these circumstances, steamers and sailing vessels have cleared out with cargoes, and, unlike former years, there has been no detention. The gas coal trade, as it usually is at Midsummer, is quiet, and the principal demand is for the better sorts, which uphold recent quotations namely, 7s. per ton net. Second-class gas coals are not much inquired after. A decent medium quality may be had in abundance at about 6s. net. The collieries in the county of Durham, which in any way depend upon local demand, continue to do very poorly. They are working short time, and there is little disposition to buy inferior gas coals, either for gas-works or for ordinary local manufacturing purposes. As the iron trade begins to improve a little, when it is seen that peace will come out of the Congress at Berlin, it is possible there will be a better demand for this sort of coal before long. The collieries may emerge then out of the present deplorable state they are in. The same report must be made about steam coals as has appeared in this column for a month. Some of the best steam collieries keep up to full time. The remainder have to make the best business they can, and refuse no reasonable offer. Most of the second-class steam collieries do little more than half time.

The coasting shipping trade continues in a very depressed state. Steamers for London took as low as 4s. per ton last week; Hamburg, £5 10s. per keel; Havre and Dieppe, 5s. 6d. per ton. Rates keep down to about £8 per keel to Cronstadt. All these are very low quotations, and we enter upon the second half of 1878 with freights strongly favouring the shippers. There seems to be an excess of tonnage in all trades, and there is no prospect of any rise for the next month or two.

The manufacturing trade of the North of England improves a little in tone. Some classes of chemicals have advanced about 2s. 6d. per ton, and there is a very hopeful sign of a prospective revival of trade in the fact that several cargoes of goods have been shipped on the Tyne for the United States of America. They consist of chemicals and fire-clay goods. Steamers are also inclined to take out cargoes of gas coals to Boston, Philadelphia, and New York.

TRADE NOTES FROM SCOTLAND.

(FROM OUR OWN CORRESPONDENT.)

The annual meeting of the Gourock Gas Company was held last Thursday, when a dividend of 7½ per cent. was declared. The Directors recommended the erection of a larger gasholder-tank, and a handsome contribution towards the lighting of two of the public clocks in the town. Both recommendations were agreed to.

The annual meeting of the Auchterarder Gas Company was held on Monday, the 24th of June—Mr. David Miller in the chair. The balance-sheet for the past year was submitted, and unanimously approved of, and the usual dividend of 10 per cent. was declared. It was agreed to light the town for another year free of expense, and to continue the use of meters at 1s. each per annum, the price of gas to remain as formerly, 7s. 11d. per 1000 cubic feet. It was likewise resolved to grant a gratuity of £10 to the manager of the works, Mr. John Christie, for his excellent services during the past year.

On Wednesday last, the annual meeting of the Dunfermline Gas Company was held—Mr. Thomas Alexander, the Chairman, presiding. The Manager, Mr. William Mackenzie, read the Directors report, in the course of which it was remarked that the general dulness and depression of trade prevailing during the past year had seriously affected the consumption of gas. This, together with a further reduction in the price to consumers, had caused the profits for the year to be somewhat below those of last year; but the Directors had great satisfaction in reporting that the whole results of the past year's business were very satisfactory. For some considerable time back the Directors had had before them applications from the inhabitants of Townhill for a supply of gas to the village from the Company's works, and the Manager was instructed to survey and report anew upon the proposal. After careful consideration and investigation of the whole matter, the Directors resolved to proceed with the work. It was hoped that the whole would be completed during the present summer; and from this extension the Directors anticipated a profitable return. Improved and extended apparatus was also being erected in the works, by which it was expected a considerable saving would be effected in the manufacture of gas. Contracts for coals for next season's supply were being made, and at prices lower than those of last year. The works and whole apparatus were in good order, and in the most efficient staté of repair. On the recommendation of the Directors, it was resolved that a dividend of 31s. 6d. per share, being at the rate of 9 per cent. per annum, be declared. Very cordial votes of thanks were awarded to the Directors, for their attention to the Company's interests during the past year, and to the Manager. It is expected by the people of Townhill who may become consumers of the Dunfermline gas, that they will have to pay from 2s. to 2s. 6d. per 1000 cubic feet more than the price in Dunfermline proper, which is 4s. 4½d., with 1s. 6d. per annum for meter hire. In the statement of assets and liabilities in the balance-sheet, the works are set down as valued at £22,099 9s. 10½d., and the total assets at £26,110 1s. 2d.

The Auchtermuchty Gas Company have reduced the price of gas from 6s. 3d. to 5s. 10d. per 1000 cubic feet.

Dr. Wallace's report on the quality of the Glasgow gas for the week ending the 22nd of June shows that in no case was the illuminating power under 26·61 standard candles. The minimum, average, and maximum results varied very little in the three districts in which the examinations were made. In the southern district, for instance, they were of respectively 27·31, 27·52, and 27·80 candles. The western district is still omitted from the weekly returns.

At last week's meeting of the Town Council of Edinburgh, Mr. J. F. King's report on the analysis of the gas supplied in that city by the Edinburgh Gas Company on the 11th of June was equal to 29·70 standard candles, and that of the Leith Company to 27·80 candles.

A special meeting of the Police Commissioners of Thurso was held last Thursday, when Mr. Leslie, the engineer for the new water-works, attended, and stated that he had inspected the track and the whole of the works, which he found, with the exception of a few small details, in a satisfactory condition, but that a formal report would be sent in due course. In consequence of this report, the account of the contractor, Mr. Scott, was adjusted, and an order passed for its payment, as also that of the engineers. The cost of the works is £12,000.

At a meeting of the Works and Finance Committees of the Dundee Water Commission, held on Saturday week, the estimates of revenue and expenditure for the year 1878-79 were adjusted, and they will be submitted to the general meeting of the Commission to be held on the 4th of July. The total expenditure for the ensuing year is set down at £32,880, and the total revenue at £33,117 10s., of which it is estimated that £650 will not be recoverable.

During the year ending the 31st of March last, the grants of loans obtained from the Public Works Loans Commissioners by local authorities in Scotland, chiefly for water supply and drainage works, under recommendation of the Board of Supervision, amounted to £175,071, the rate of interest, varying with the length of time for repayment, from 3½ to 4 per cent. per annum.

The past week's Glasgow pig iron market was very steady, but only a limited amount of business was done. There was very little fluctuation in prices, and on Friday afternoon 50s. 2d. one month was accepted, and the market closed with buyers at 50s. 1d. cash, and 50s. 2d. one month, sellers asking ½d. per ton more. The gain over the week was 1d. per ton. Shipments at present are disappointingly low.

Dulness of a very pronounced character is still the order of the day in the Scotch coal trade. The demand has now settled down into proportions that are unusually small for the summer season.

It has been intimated during the past week that Mr. Samuel Spencer, A.Inst.C.E., for many years London Manager of the Horseley Company, Limited, the well-known engineers, ironfounders, and gasholder makers, has joined the firm of Messrs. James E. Spencer and Co., of Cannon Street, London, and that from present date the business will be carried on under the style of James E. and Samuel Spencer.

Reductions in the Price of Gas.—The Shipley Gas Company have given notice that from the 1st inst. the price of gas will be reduced to 3s. 4d. per 1000 cubic feet to all consumers who pay within one month from date of quarter's account, but no deduction from the price of 4s. 2d. per 1000 cubic feet will be allowed on any account not paid within the above specified time.

Street-Main Joints.—At the annual meeting of the New England Association of Gas Engineers, Mr. Thomas, of Williamsburgh, made the following remarks on this subject:—"In my early experience with the Williamsburgh Gaslight Company, with which I became connected in the year 1854, I found pretty nearly all the street-mains that were laid were connected with cement joints. While there is no doubt in my own mind that a joint can be made perfectly tight with cement, I much prefer the lead joint. Another thing to be taken into consideration to keep tight joints is, that the mains should be laid a sufficient depth under the surface to protect them from the action of severe frosts. A great many of the mains were not more than 18 inches or 2 feet below the surface of the streets, and at this depth in our climate it is a matter of impossibility to keep joints tight, as the action of the frost in winter will displace the mains and cause the joints to leak. From the bad manner in which our mains were laid, and the cement joints leaking so much, we could not afford to turn gas on during the day. Had we done so we should not have had any to supply the city at night, and we were thus compelled to shut off the gas just as soon as there was any apology for daylight, and keep it shut off as late as possible in the evening. With the most careful working in this manner, for a period of nine or twelve months, our losses from leakage amounted to about 52 to 55 per cent. of the gas manufactured. A great part of this loss was caused by the cement joints leaking, and also a part due to the fact that the mains were not of sufficient depth under the surface to protect them from the action of the frost. As soon as we possibly could I went over the whole of our mains (there was about 17 miles in all), stripping them, cutting out the cement, and rejointing them with lead. In one season we got the loss from leakage down to 20 per cent., and this with the gas turned on during the 24 hours of the day. One great objection to cement joints is the rigidity of them; in cases where pipes have been disturbed by other excavations and settled, I found in all cases that the mains were broken. In a leading main from our old works, with cement joints, the main, a 10-inch one, was broken entirely off and fractured lengthwise besides, by the upheaval of the ground from frost. In some of the same mains that we had rejointed with lead the mains were drawn apart, drawing the lead out, but with very little loss of gas, as the gasket being driven in tight prevented any great leakage. In cases of this kind the lead was easily driven back, and the joint made perfectly tight again. I have never, in our city, put in any street-mains that I have not used lead in the joints, and in laying mains we always make them gas-tight with the gasket used. At the present time we have over 90 miles of street-mains laid, and outside of our loss from street-lamps (we get paid for 3-feet burners and they average about 3¼ feet) our loss from leakage will not exceed 6 per cent. We have suffered severe loss of gas from sewering in our city. In some cases where there are railroad tracks in the streets, the sewers have been run on both sides of the street, alongside and parallel with our pipes; these excavations are much deeper than our mains lie, and the earth is always filled in loosely and left to settle. In cases of this kind, we have had whole blocks of mains dragged down, the pipe broken, and the joints partially pulled apart; at the same time the leakage from the joints was not so great, the gasket preventing the leakage. In laying street-mains, what you want particularly to attend to, and especially in the east here, where you have colder weather than we have (we have not seen much winter until we came on here) is to get them down under the surface a sufficient depth to protect them from the frost. With us the least depth is 2 feet 9 inches under the surface of the street, and I am confident, could our mains remain in the ground as we put them down, our loss from leakage by them would be very small indeed; while, as I stated in the beginning, I have no doubt that a cement joint can be made tight. I can see no benefit in using cement for the purpose, as I consider lead far superior in accommodating itself to any upheaval or settling of the earth where the mains are laid down."

Register of New Patents.

819.—Hallewell, R., Blackburn, "*Improvements in gas motor engines and in the valves of such engines.*" Patent dated Feb. 28, 1877.

This invention relates to the class of engine having two pistons working in connection with one cylinder, and the invention comprises—

1. An improved apparatus for momentarily holding or suspending the "loose" or supplementary piston and piston-rod in position during the effective or "in" stroke of the working piston, which latter is connected with the crank-shaft.

2. An improved combination and arrangement of shafts and gearing for transmitting the motion from the crank-shaft.

3. An improved construction of valve to be used in connection with

the gas motor engine above referred to, or in connection with other descriptions of gas motor engine.

840.—WIRTH, F., Frankfort-on-the-Maine, "*A new filling for gas-meters.*'. A communication. Patent dated March 2, 1877.

By this present invention there has been found a novel non-freezing filling which does not freeze with the greatest degree of cold. It does not injure the meter, and does not decompose the gas passing through the meter. This filling is 25 times cheaper than glycerine.

The filling to which this invention relates consists of a solution of chloride of magnesium ($Mg\ Cl_2$) in water. This solution may be of any strength; however, for moderate climates, a solution of 14 parts of chloride of magnesium to 86 parts of water will suffice; but for the coldest climates a solution of 30 parts of chloride of magnesium to 70 of water will be found sufficient.

In lieu of the chloride of magnesium, chloride of calcium (Ca Cl) may be employed. This latter may be used in the same proportions, dissolved in water as the chloride of magnesium, and has the same non-freezing qualities.

842.—TRULL, C. K., New York, "*An improved apparatus for lighting gas.*" Patent dated March 2, 1877.

This improved apparatus or torch communicates light to the gas by the ignition of a prepared tape, or strip of paper, or other suitable material, which forms a tape fuse, and which is ignited by percussion.

The invention is carried into practice as follows:—The torch has a rod or stem of convenient length, and formed of iron, brass, or other suitable material. This stem is provided with a suitable handle, and has at its other end a pair of jaws, or other means, for opening and closing the taps of the gas-burners. The rod, or stem, has at its side another rod, or stem, projecting from the handle, and which, at its other end, is bent or curved. This curved rod is hollow, or tubular, and has at its curved end a fuse-holder, provided at its extremity with a small bell-shaped piece. Just above the latter is a small chamber, which contains the tape fuse. In the passage between the fuse chamber and bell there is an anvil and a spring hammer, between which the tape fuse passes. The hammer is raised by a small slide, which feeds the tape forward a determined distance every time the torch is used. The end of this slide extends through the neck of the fuse-holder to the curved portion of the tubular rod, in which are placed segments of a rod, which segments form a continuation of a rod that extends through the tubular rod to the handle of the torch. The neck of the fuse-holder is provided with a spring, which tends to keep the end or head of the slide in contact with the segment which forms the termination of the inner rod. The other end of this inner rod is connected with a trigger, arranged near the handle in a convenient position. By applying the bell, or cup-shaped piece, over the gas-burner, and pulling the trigger, the gas will be ignited.

APPLICATIONS FOR LETTERS PATENT.

2477.—WERDERMANN, R., Princes Street, Surrey, "Improvements in apparatus for electric lighting." June 21, 1878.

2489.—REDWOOD, T., Lower Clapton, London, "Improvements in the manufacture of gas for burning." June 22, 1878.

2516.—MEAD, W., Laurence Pountney Hill, London, "An improved process for converting into caustic lime, spent lime which has been used in the purification of illuminating gas." A communication. June 24, 1878.

2525.—BOULTON, M. P. W., Tew Park, Oxford, "Improvements in gas motor engines." June 25, 1878.

2526.—KIRKHAM, T. N., Westminster, and CHANDLER, S., Newington Causeway, London, "Improvements in gas purifiers or scrubbers." June 25, 1878.

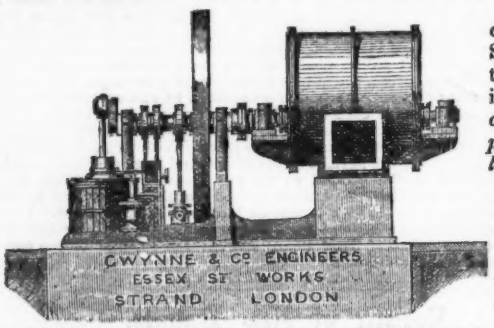
Share List of Gas and Water Companies.

(*Corrected by Mr.* F. N. GOLDING, *Sun Court, Cornhill, from the latest Stock Exchange Quotations.*)

Number of Shares issued.	Amount per share.	Name.	Amount paid up per Share.	Last Divd. p.Cent. p. Ann.	Latest Quotations.	Number of Shares issued.	Amount per Share.	Name.	Amount paid up per Share.	Last Divd. p.Cent. p. Ann.	Latest Quotations.	Number of Shares issued.	Amount per Share.	Name.	Amount paid up per Share.	Last Divd. p.Cent. p. Ann	Latest Quotations.
	£	GAS COMPANIES.	£ s. d	£ s. d	£		£	GAS COMPANIES.	£ s. d	£ s. d	£		£	GAS COMPANIES.	£ s. d	£ s. d	£
589892	10	Alliance and Dublin	10 0 0	10 0 0	17¼–18¼	6200	5	Georgetown, Guiana	5 0 0	5 0 0	..	12500	5	Singapore (Limited	5 0 0	7 10 0	5¼–5¾
10000	20	Anglo-Romano . .	20 0 0	10 0 0	20–24	300000	100	Glasgow Corporation Gas	100 0 0	9 0 0	212–217	2000	5	Do., preference .	5 0 0	7 10 0	5¾–6¼
5000	20	Bahia (Limited). .	20 0 0	3 0 0	10–11			Do., do.	100 0 0	6 15 0	160–163	4000	50	South Metropolitan	50 0 0	11 0 0	106–109
1000	20	Do., do., redeem.	20 0 0	10 0 0	25–27	115000	100	Grimsby Gas, A . .	100 0 0	..	203–205	4000	12½	Do.	12 10 0	11 0 0	24–26
1500	20	Do., 2nd pref. . .	20 0 0	7 10 0	..	..	100	Hampton Court . .	10 0 0	10 0 0	17¾–18¾	20000	12½	Do., new shares .	12 10 0	11 0 0	12¾–13¼
40000	5	Bombay (Limited).	5 0 0	7 10 0	6¾–7¼	..	10	Hornsey	.. ..	.. ..	..	15000	10	Surrey Consumers.	10 0 0	10 0 0	pm.
10000	5	Do., fourth issue.	4 0 0	7 0 0	5–5½	7800	10	Hong Kong (Lim.)	10 0 0	10 0 0	17–19	10000	10	Do., new	8 0 0	10 0 0	18¼–19½
5000	20	Bournemouth . . .	10 0 0	3 0 0	..	..	..	Hounslow	.. ..	.. ..	..		5	Tottenham and Edmonton	5 0 0	10 0 0	6–7
229700	..	Brentford	100 0 0	9 0 0	165–175	20000	50	Imperl. Continental	100 0 0	5% p.sh.	185–190	..					10¼–11
..	..	Do., 5 per ct. pref.	100 0 0	5 0 0	105–110	..	..	Kingston	.. ..	.. ..	..						
..	20	Do., C shares . .	10 0 0	9 0 0	..	..	..	Lea Bridge	.. ..	.. ..	..	1500	10	Wandsw. & Putney	10 0 0	10 0 0	19–20
5400	20	Brighton	20 0 0	9 0 0	35–37	9000	4	Limerick Gas . . .	4 0 0	2 10 0	3–3½	1500	10	Do.	10 0 0	7 10 0	14–15
5000	20	Brighton and Hove	20 0 0	10 0 0	35–37	561001.	100	Liverpool United .	100 0 0	10 0 0	199–201	2957	10	Do.	10 0 0	7 0 0	..
13000	20	British (Limited) .	20 0 0	10 0 0	38–40	1691001.	100	Do., B	100 0 0	7 0 0	145–147	993	10	Do.	3 0 0	7 0 0	..
7223	20	Cagliari (Limited).	20 0 0	6 0 0	16–18	3849001.	Sk.	London	100 0 0	10 0 0	183–188	..	..	West Kent	..	..	..
..	10	Colney Hatch . . .	10 0 0	4 0 0	9–10	1622501.	Sk.	Do., 1st pref. . .	100 0 0	6 0 0	125–135	..	..	Woolwich, Plmstd., and Charlton . .	..	..	..
55000	Sk.	Commercial	100 0 0	10 10 0	188–193	14450	Sk.	Do., 2nd pref. . .	100 0 0	6 0 0	..						
70000	100	Do., 7 per cent. .	100 0 0	7 0 0	135–140	4350	Sk.	Do., 3rd pref. . .	100 0 0	6 0 0	..	26000	5	West Ham	5 0 0	10 0 0	9–10
20000	20	Continental Union.	20 0 0	6 0 0	20¼–21½	7622	25	Do., A shares . .	..	6 0 0	..						
20000	20	Do., new	12 10 0	6 0 0	par-1 pm	266921.	All	Do., Debent. stk.	100 0 0	5% & 6%	..			WATER COMPANIES.			
10000	20	Do., preference .	20 0 0	7 0 0	24–26	15000	5	Malta and Mediterranean (Limited).	5 0 0	2 10 0	2½–3	615600	100	Chelsea	100 0 0	6 0 0	147–150
75000	Sk.	Crystal Palace Dist.	100 0 0	10 0 0	190–195												
125000	Sk.	Do., 7 per cent. .	100 0 0	7 0 0	135–140	6000	5	Do., preference .	5 0 0	7 10 0	6–7	1624700	100	East London . . .	100 0 0	6 0 0	150–154
50000	Sk.	Do., preference .	100 0 0	6 0 0	125–130	20000	5	Mauritius (Limited)	2 5 0	2 10 0		10798	50	Grand Junction . .	50 0 0	5 0 0	82–84
7100	25	Edinburgh	25 0 0	10 0 0	52–53	25000	20	Monte Video (Lim.)	20 0 0	8 0 0	17¼–18½	5840	25	Do., ¼ shares . .	25 0 0	5 0 0	41–42
23406	10	European (Limited)	10 0 0	10 0 0	17–18	8000	10	Nictheroy, Brazil (Limited)	10 0 0	5 0 0	..	6160	25	Do., new ditto; max. div., 7½ p.c.	25 0 0	5 0 0	33–34
12000	10	Do., new shares.	7 10 0	10 0 0	6–7 pm.												
35406	10	Do., new shares .	5 0 0	10 0 0	4–4½ pm.	30000	5	Oriental (Calcutta).	5 0 0	9 10 0	7–7½	5551801.	100	Kent	100 0 0	8 0 0	200–205
40948401.	Sk.	Gaslight & Coke A.	100 0 0	10 0 0	185–190	30000	5	Do., new shares .	3 0 0	9 10 0	1½–1¾ pm	7818001.	100	Lambeth	100 0 0	6 5 0	149–153
1000001.	Sk.	Do. B.	100 0 0	4 0 0	78–82	10000	5	Ottoman (Limited).	5 0 0	3 0 0	2–2½	3261501.	100	Do., max., 7¼ p.c.	100 0 0	6 5 0	148–151
50000	10	Do. 5 per ct. pref. conv., 4th issue.	10 0 0	5 0 0	16–17	10000	10	Pará (Limited) . .	10 0 0	3 0 0	4¼–5¼	442	100	New River	100 0 0	7 0 0	320–350
						27000	20	Phœnix	20 0 0	10 0 0	37–38	4475	100	Do.	85 0 0	7 0 0	280–300
50000	10	Do. do., 5th do. .	6 0 0	5 0 0	5–6pm.	3600001.	100	Do., new max. 7%	70 0 0	7 10 0	102–107	400000	100	Do., deb. sk., 4 p.c.	100 0 0	4 0 0	101–103
2000001.	Sk.	Do. C 10 p.c. pref.	100 0 0	10 0 0	212–217	1440001.	Sk.	Do., capitalized .	100 0 0	5 0 0	101–104	6668001.	100	Southwrk. & Vauxh.	100 0 0	2 0 0	105–108
3000001.	,,	Do. D do. do.	100 0 0	10 0 0	212–217		20	Do., new, 1876. .	6 0 0	10 0 0	14–15pm	3247001.	100	Do., pref. stock .	100 0 0	5 0 0	115–117
1650001.	,,	Do. E do. do. .	100 0 0	10 0 0	212–217	..	..	Richmond (Surrey)	.. ..	.. ..	..	1265001.	100	Do., D shares . .	100 0 0	4 0 0	103–105
300001.	,,	Do. F 5 do. do. .	100 0 0	5 0 0	105–107	37500	20	Rio de Janeiro (L.)	20 0 0	10 0 0	31–33	700001.	100	Do., new ordinary	..	4 10 0	..
600001.	,,	Do. G 7½ do. do. .	100 0 0	7 10 0	145–155	1500	32½	Shanghai	32 10 0	12 0 0	30–32	1600	100	Do., new ord. No. 1	40 0 0	4 10 0	..
13000001.	,,	Do. H	100 0 0	7 0 0	136–141	..	100	Sheffield, A, B, & C.	100 0 0	10 0 0	208–210	15073	61	West Middlesex . .	61 0 0	6% p.sh.	138–141

The GRAND MEDAL of MERIT at the VIENNA EXHIBITION, and TWO MEDALS at the PHILADELPHIA EXHIBITION, have been AWARDED to GWYNNE & CO. for GAS-EXHAUSTERS, ENGINES, and PUMPS; Also 27 OTHER MEDALS AWARDED at all the GREAT INTERNATIONAL EXHIBITIONS.

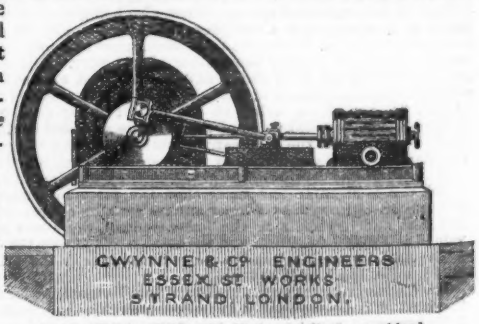
GWYNNE & BEALE'S PATENT GAS-EXHAUSTERS & ENGINES.



EXHAUSTER with Trunk Engine, capable of passing 210,000 cubic feet per hour.

The Judges report on the combined Exhauster and Steam-Engine exhibited at the Philadelphia Exhibition is—"*Reliable compact Machine, well adapted for the purpose intended, of excellent workmanship.*"

GWYNNE & CO. have made the largest and most perfect Gas-Exhausting Machinery in the world, and have completed Exhausters to the extent of 7,000,000 cubic feet passed per hour, of all sizes from 2000 to 210,000 cubic feet per hour.



52,500 EXHAUSTER, with Horizontal Engine combined.

GWYNNE & CO. do not pretend to enter into a struggle with other makers in respect to cheapness. They have never sought to make price the chief consideration, *but to produce machinery of the very highest quality, and most approved design and workmanship.* The result is that in every instance their work is giving the fullest satisfaction. Numerous testimonials and references can be given to Companies using their Machinery for years past.

Exhausters, with or without Engines combined, can be made to pass the gas without oscillation or variation in pressure Regulators, Bye-Passes, Stop-Valves, Gas-Valves, Station Governors, and Gas Machinery of all Sizes.

PLEASE ADDRESS IN FULL, GWYNNE & CO., Hydraulic and Gas Engineers, ESSEX STREET WORKS, VICTORIA EMBANKMENT, LONDON, W.C., ENGLAND.

Gwynne & Co.'s New Catalogue on Gas-Exhausting and other Machinery may be obtained on application at the above Address.

WANTED, by a Married Man, a Situation as MANAGER of a small Gas-Works, or as Head STOKER in large Works, with good testimonials, by the 13th of July.
Address No. 469, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

A Young Man, aged 19, desires a Situation as RENTAL CLERK. Has had three years experience in the Office of a large Provincial Company. Has some knowledge of French and Chemistry.
Address No. 470, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

WANTED, by a Practical Man, a Situation as Working Manager of a medium-sized Gas-Works, or Meter Inspector and Foreman of large Works. Able to take charge in the absence of the Principal. First-class testimonials.
Address No. 471, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

A Young Man, aged 22, who has just finished a four years engagement with a provincial Gas Company is open to take a situation as Manager of small Gas-Works, or as Assistant to the Engineer of large Works. Can give first-class testimonials. Has no objection to go abroad.
Address No. 460, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

WANTED, by a Young Man, aged 22, who has had five years experience in a Provincial Works (make, 75 millions), a SITUATION in a Gas-Works. Can use Photometer, fair Draughtsman, good Writer, quick at figures, and thoroughly understands general routine.
Apply S. I. C. E., 54, Hardress Street, RAMSGATE.

TO GAS ENGINEERS AND MANAGERS.

THE Advertiser seeks an engagement as FOREMAN of Retort Setters, or RETORT SETTER by Contract or Day. Now employed by The Gaslight and Coke Company, Beckton Works. Good references.
Addess J. I., 62, Albert Road, NORTH WOOLWICH.

WANTED, to invest from £5000 to £20,000 in the PURCHASE of Gas-Works.
Apply, by letter only, with full particulars, to No. 466, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

WANTED, by Samuel Thompson & Co., Colliery Office, Lancaster, APPLICATION for PRICES from Gas Managers who are prepared to receive Tenders for GAS COAL or CANNEL.
John Leigh, Esq., M.R.C.S., F.C.S., &c., &c., in his analytical report of S. T. & Co.'s Coal, says: "It is remarkable for its purity, I have scarcely ever examined a Coal containing so small a quantity of ash, and when Cannel of the best description is scarce, it may well replace this material."

HENRY LYON (14 years Engineer and Manager of the largest of the Manchester Corporation Gas-Works) Mechanical and Consulting Gas Engineer, reports upon the condition and value of Gas-Works, supplies plans and specifications of all Apparatus appertaining to Gas-Works, and re-models existing Works.
Address Brooklyn, near Halliwell Lane, Cheetham Hill Road, MANCHESTER.

NORTH BRITISH ASSOCIATION of GAS MANAGERS.

THE
SEVENTEENTH ANNUAL GENERAL MEETING
of the Members of this Association will be held in the
UNITED COLLEGE BUILDINGS,
ST. ANDREW'S,
On THURSDAY & FRIDAY, July 11 & 12, 1878.
J. HALL, Esq., PRESIDENT,
Will occupy the Chair.

PROCEEDINGS.

THURSDAY, JULY 11.
BUSINESS MEETING.
Chair to be taken at Half-past Ten o'clock A.M.
Reading of Minutes.
Admission of New Members, &c.
PRESIDENT'S INAUGURAL ADDRESS.
Auditor's Report.
Election of Office-Bearers.

LIST OF PAPERS AND COMMUNICATIONS.

"How should the Illuminating Value of Gas be Determined?" By Mr. A. MACPHERSON, of Kirkcaldy.
"The Necessity for a Proper Control over the Pressure of Gas for Illuminating Purposes." By Mr. ALEXANDER MITCHELL, of Dundee.
"Governors for Lamps and Stair Lights," with Description of an Improved Metallic Governor, which will be shown in action. By Mr. D. BRUCE PEEBLES, of Edinburgh.
"A Graduatory Method of Condensing, Washing, and Purifying Coal Gas by a Combined System of Rotary Apparatus." By Mr. D. M. NELSON, of Glasgow.

DINNER.

At Half-past Four o'clock, the Members and Friends will Dine together in the "Royal" Hotel, St. Andrew's. Tickets for the Dinner, 5s. each, may be had from the Secretary; early application for which is specially requested.

FRIDAY, JULY 12.
Chair to be taken at Ten o'clock.
Reading of Papers, and Discussion not completed, will be resumed.

PRIZE PAPERS.
COMMITTEE'S REPORT THEREON.

Gas Apparatus of various kinds will be exhibited in operation, and described.
WM. MACKENZIE, Secretary.
Gas-Works, Dunfermline, June 28, 1878.

TO BE SOLD—Thirty Shares in the Lynn Gas Company, together or in lots.
Apply to Messrs. HARWAR AND CO., Furnival's Inn, LONDON, E.C.

FOR SALE – One 50 ft. by 14 ft. Gas-HOLDER, nearly new, with Columns and Girders. Price £225, a bargain.
Also a STATION-METER, in good working order, to pass 15 000 feet per hour; and Four 10 ft. PURIFIERS with Hydraulic Centre-Valve.
Apply to J. S. REEVES, Manager, Gas-Works, BILSTON.

TO BE SOLD—The Stanstead and St. MARGARET'S GAS-WORKS, Hertfordshire.
For price and particulars, apply to GEORGE DAVIS, Wilmington, HULL.

TWO Purifiers, 6 ft. by 4 ft., 6-in. Valves and Connections, with Lifting Apparatus and Girders complete; also a Set of Twelve Pipe Condensers, all in working order, to be SOLD, a bargain.
Apply to Manager, Gas-Works, ENFIELD.

ON SALE—A Station-Meter (with new Drum), capable of passing 10,000 cubic feet per hour, with Hydraulic Valves, Bye-Pass, &c.; 10-in. Connections. Has been removed to make room for one of larger capacity.
For particulars and price, apply to GEORGE NEWTON, Gas-Meter Manufacturer, Union Street West, OLDHAM.

FOR SALE—The Newent Gas-Works, consisting of Retort-House, with bed of three and two beds of two retorts; Meter-House and Station-Meter; Purifying-House and two Purifiers; Lime and Store Sheds, Condensers, and Gasholder to contain about 5000 cubic feet; Manager's House and Office, all enclosed, together with the Mains throughout the town, Street-Lamps, Posts, Fittings, and Consumer's Meters.
The average make of Gas is about 1,500,000 cubic feet per annum; price, 8s.; and the consumption is steadily increasing. A line of railway will shortly be open, and there is a coal works within two miles of the town.
For further particulars, apply by letter, addressed E. E., 61, Portsdown Road, Maida Vale, LONDON.

SULPHATE OF AMMONIA PLANT.

THE Newest, Best, and Cheapest Plant for Making SULPHATE of AMMONIA. Plans may be obtained for the erection of this economical and efficient apparatus, or tracings of plans with specifications. Terms moderate.
Address JOHN G. HARVEY, Little Island, CORK.

AMMONIACAL LIQUOR AND GAS TAR.

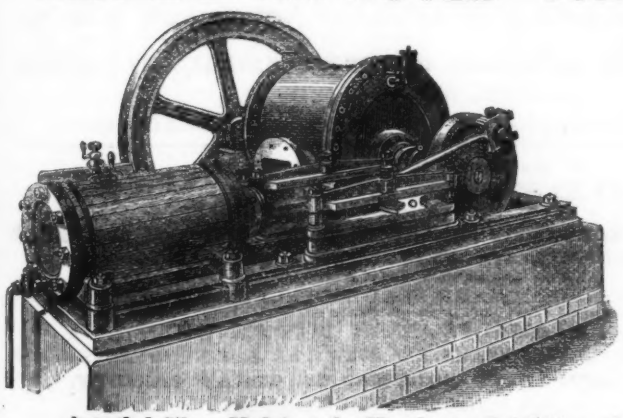
THE Southport Corporation invite Ten-DERS for the Purchase of all the AMMONIACAL LIQUOR that they will produce, and the Surplus GAS TAR that they will have to dispose of, at their Gas-Works, for the next One, Two, or Three years, from Nov. 18 next.
Form of tender and further information will be supplied on application to Mr. Iddon, the Manager.
Sealed tenders to be sent to me not later than Wednesday, July 10 next, endorsed, "Tender for Ammoniacal Liquor, or Gas Tar."
By order,
KEIGHLEY WALTON, Town Clerk.

BEALE'S IMPROVED PATENT GAS EXHAUSTERS

WITH

Wrought-Iron Spindles and

ENGINES COMBINED.



SOLE MAKERS,

GEORGE WALLER & CO.

MAKERS OF ENGINES, EXHAUSTERS,
INDEX AND DISC GAS-VALVES,
HYDRAULIC MAIN VALVES,
BYE-PASS VALVES,
TAR, LIQUOR, AND OTHER PUMPS,
SCRUBBERS AND PURIFIERS,
CONDENSERS, BOILERS, &c.

Awarded Silver Medal at the Manchester Exhibition of the Society for the Promotion of Scientific Industry.

Phœnix Engineering Works:

HOLLAND STREET, SOUTHWARK, S.E.

TO GAS ENGINEERS.

D. BRUCE PEEBLES & CO.

Beg to call the attention of Gas Engineers to the fact that the novel and original feature in connection with PEEBLES' SYSTEM OF CONTROLLING THE ACTION OF GAS GOVERNORS is the loading or acting on the Bell by Pneumatic Pressure instead of Weights.

TAY WORKS, BONNINGTON, EDINBURGH.

HERNE BAY GAS AND COKE COMPANY.

TENDERS required for Gasholder 30 ft. by 16 ft., with Cast-Iron Tank, &c., complete. Fitted at Gas-Works, Herne Bay.

Specification, 2s. 6d., can be obtained at the Office, 66, Chancery Lane, W.C. H. E. NEWTON, Secretary.

TAR AND AMMONIACAL LIQUOR CONTRACT.

THE Directors of the Isle of Thanet Gas Company are prepared to receive TENDERS for their Surplus TAR and the entire produce of AMMONIACAL LIQUOR at the Margate Works for One year. Coals carbonized, 5100 tons. The Company will undertake to fill the barrels when left on their premises, but all other expenses to be paid by the Contractor.

The Directors do not bind themselves to accept the highest or any tender.

Tenders to be addressed to the Chairman of the Company, the Dane, Margate, on or before Wednesday, July 17, 1878.

THOMAS C. FULLER, Secretary.

Margate, June 28, 1878.

TO IRONFOUNDERS, IRONMONGERS, AND OTHERS.

THE Ystradyfodwg Urban Sanitary Authority are desirous of receiving TENDERS for Supplying about 150 Cast-Iron LAMP-POSTS, according to specification. To be delivered in any such quantities as may be required at any station between Porth and Treherbert and Porth and Ferndale on the Taff Vale Railway, carriage paid.

For specifications and forms of tender apply to Mr. J.W. Jones, the Board's Surveyor, Danygraig House, Porth.

Sealed tenders to be sent to me on or before the 4th day of July next.

WALTER H. MORGAN, Clerk to the Board.

Pontypridd, June 22, 1878.

TO IRONMONGERS, LAMP MANUFACTURERS, AND OTHERS.

THE Ystradyfodwg Urban Sanitary Authority are desirous of receiving TENDERS for the Supply of about 150 Copper-framed STREET-LAMPS, Fixing Lamp-Posts, and other work in connection therewith, in accordance with specification.

For specifications and forms of tender, apply to Mr. J.W. Jones, Surveyor to the Board, Danygraig House, Porth, Pontypridd.

Tenders to be sent to me on or before the 4th of July next.

WALTER H. MORGAN, Clerk to the Board.

Pontypridd, June 22, 1878.

WIDNES GAS-WORKS.

THE Gas Committee of the Widnes Local Board invite TENDERS for the REPLATING of a Single-Lift Gasholder, 50 ft. by 20 ft.

Specification and form of tender can be obtained from the undersigned.

Tenders, endorsed "Gasholder," and addressed to the Chairman of Gas and Water Committee, to be delivered at the Public Offices, Widnes, not later than the 1st of August next.

The Board do not bind themselves to accept the lowest or any tender.

HENRY ROBERTS.

Public Offices, Widnes, June 18, 1878.

COAL CONTRACT.

THE Directors of the Stratford-upon- Avon Gas Company invite TENDERS for the Supply of 2000 Tons of good screened GAS COAL, to be delivered free upon their Siding, Great Western Railway Company, in monthly quantities, as may be required, between July 1, 1878, and June 30, 1879.

The Coal to be of good quality, and free from bats, bind, pyrites, and other refuse.

Parties tendering to state the kind of Coal, and from what district and pits obtained.

Terms of payment, net cash, monthly.

Tenders to be sent in not later than Monday, July 8, 1878.

The Directors do not bind themselves to accept the lowest or any tender.

J. S. CRANMER, Secretary.

June 21, 1878.

CITY OF CARLISLE.

TENDERS FOR COAL AND CANNEL.

THE Carlisle Gas Committee are pre- pared to receive TENDERS for from 5,000 to 10,000 tons of the best Screened Gas Coal, and about 3000 tons of CANNEL, to be delivered at Carlisle in such quantities as may be directed, from July, 1878, to June, 1879.

Tenders, specifying the description of Coal or Cannel, the pits at which they are raised, and the terms for net monthly payments, are to be sent to me on or before July 4, 1878, endorsed "Tender for Coal."

J. HEPWORTH, Engineer and Manager.

Gas-Works, Carlisle, June 26, 1878.

MANCHESTER CORPORATION GAS-WORKS.

AMMONIACAL LIQUOR.

THE Gas Committee of the Corporation of Manchester are prepared to receive TENDERS for the Purchase of the AMMONIACAL LIQUOR to be produced at their Gaythorn and Rochdale Road Works during a period of One or more years, commencing from the 1st day of January, 1880.

In addition to tenders for the purchase of the Liquor in its crude state, the Committee will also be prepared to consider TENDERS for its DISPOSAL, either by manufacture into Sulphate of Ammonia at the above-mentioned Works on their behalf, or in any other manner.

The Committee reserve to themselves the option of accepting the offer, the terms of which they may deem most advantageous.

They do not bind themselves to accept the highest or any tender.

Sealed tenders, addressed to the Chairman of the Gas Committee, Town Hall, and endorsed "Tender for Ammoniacal Liquor," must be delivered at these Offices, on or before Thursday, the 1st day of August next.

Forms of tender and further particulars can be obtained on application to Mr. George B. Jackson, at the Gas Offices. By order of the Gas Committee,

JOSEPH HERON, Town Clerk.

Town Hall, Manchester, May 31, 1878.

Will be ready by July 8, price 10s. 6d.,

AN ANALYSIS OF THE

METROPOLITAN GAS COMPANIES ACCOUNTS

FOR 1877,

(In continuation of the Eight previous Years, 1869–1876,)

COMPILED AND ARRANGED BY JOHN FIELD,

MANY YEARS ACCOUNTANT TO THE LATE IMPERIAL GAS COMPANY.

Now ready by the same Author,

A COMPARATIVE AVERAGE ACCOUNT BOOK,

FOR THE ENTRY OF GAS COMPANIES ACCOUNTS FOR SERIES OF YEARS.

Price, for Half Yearly and Yearly Comparison, Foolscap Size, 21s.; Quarto, 12s. 6d; for Yearly Comparison only, Quarto, 8s. 6d.

To be had of W. B. KING, "Journal of Gas Lighting," 11, BOLT COURT, FLEET STREET, E.C.;

OR OF

EDEN FISHER & CO., Stationers and Engravers, 50, LOMBARD STREET, LONDON, E.C.

BEST GAS COALS

DIRECT FROM THE

MARQUESS OF LONDONDERRY'S COLLIERIES,

COUNTY OF DURHAM.

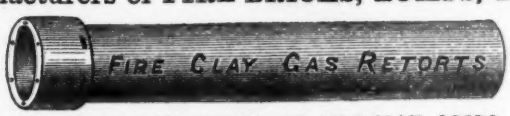
For Prices and Particulars, apply to

MR. S. J. DITCHFIELD,

LONDONDERRY OFFICES, SEAHAM HARBOUR, COUNTY OF DURHAM.

JOHN HALL AND CO., STOURBRIDGE,

Manufacturers of FIRE-BRICKS, LUMPS, TILES,



AND EVERY DESCRIPTION OF FIRE-CLAY GOODS.

N.B.—A Stock of 15 and 16 in. CIRCULAR RETORTS always on hand. Other kinds made to order on short Notice.

JAMES MILNE & SON,

GAS ENGINEERS,

Gas-Meter, Gas Apparatus, and Gas-Fittings Manufacturers,

EDINBURGH, AND

2, KING EDWARD STREET,

NEWGATE STREET, LONDON.

Meter Works in London—2, CROSS STREET, WILDERNESS ROW, E.C.

STATION-METERS, GOVERNORS, CONSUMERS METERS, GAS LUSTRES, CHANDELIERS, BRACKETS, &c.,

And every description of Gas-Fittings and Gas Apparatus.

TO GAS COMPANIES AND THE TRADE.

J. DEFRIES & SONS,

MANUFACTURERS OF

CRYSTAL, BRONZED, & ORMOLU CHANDELIERS, IMPROVED CRYSTAL STAR & SUN LIGHTS VESTIBULE LAMPS, AND THE PATENT CRYSTAL ILLUMINATION.

A LARGE STOCK ALWAYS IN HAND OF

IRON, BRASS, COMPOSITE, AND LEAD TUBES, FOR GAS AND WATER,

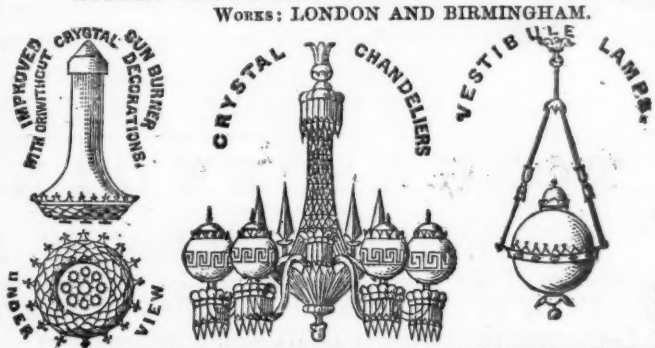
AND EVERY DESCRIPTION OF

GAS AND WATER FITTINGS.

THE PATENT DRY AND WET METER, WITH THE LATEST IMPROVEMENTS.

STREET LAMPS AND COLUMNS IN GREAT VARIETY.

WORKS: LONDON AND BIRMINGHAM.



GAS MOONS, Cut and Engraved, of the newest designs

GAS REFLECTORS In Silver and Glass

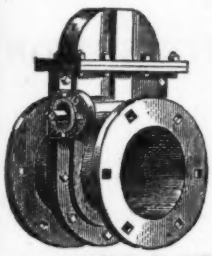
GAS NIBS AND BURNERS Of every description.

Pattern-Books of Gas-Fittings, Crystal and Ormolu Chandeliers for 1876, are now complete.

City Show-Rooms and Manufactory, 147, HOUNDSDITCH, LONDON.

ESTABLISHED 1830.

B. DONKIN & Co.'s
IMPROVED GAS-VALVES
WITH WROUGHT-IRON PINIONS.



List of prices, with full dimensions of all sizes up to 48-inch, to be had on application.

These Valves are proved on both sides to 30 lbs. on the square inch before leaving the works, and are kept in stock.

In ordering Valves, please state whether required for under or above ground, and if to be with flanges or spigots and sockets cast on, or with separate spigot and socket pieces.

ALSO SOLE MAKERS OF
J. BEALE'S NEW PATENT GAS EXHAUSTERS,
AND MAKERS OF
STEAM-ENGINES FOR DRIVING GAS EXHAUSTERS,
VALVES FOR AMMONIACAL LIQUOR,
IMPROVED BRIDGE VALVES FOR REGULATING THE SEAL IN HYDRAULIC MAINS,
BYE-PASS VALVES, SCREW WATER-VALVES, &c.

B. DONKIN & CO., 55a, BLUE ANCHOR ROAD, BERMONDSEY, LONDON, S.E

THE THAMES BANK IRON COMPANY,
(Successors to LYNCH WHITE,)
SUPPLY FROM STOCK
CAST-IRON RETORTS, SOCKET-PIPES for GAS or WATER PURPOSES, FLANGE-PIPES for STEAM, RAIN-WATER PIPES and GUTTERS, HOT-WATER PIPES and BOILERS, and all requisite Connexions for same; also LAMP-COLUMNS, LAMPS, WROUGHT FRAMES, WROUGHT-IRON TUBING, &c., &c.

All kinds of Gas-Works Apparatus and General Castings made to Pattern or Drawing.

ADDRESS—
OLD BARGE WHARF, UPPER GROUND STREET, LONDON, S.E.

A PAMPHLET ON DIP-PIPES, &c., post free 6½d., on application to W. White, Gas-Works, Abersychan, Mon. See Reviews in the *Gas Trade Circular and Review*, March 29, 1878, and *Design and Work*, March 30, 1878.

W. LIDDALL,
Public Accountant,
15, UNION COURT,
OLD BROAD STREET, E.C.

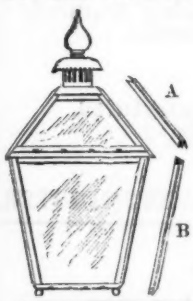
MANN & OWENS
PATENT SCREW & CAM GAS-VALVES.
SIZES from 2 In. to 48 In.

As supplied to
THE GASLIGHT & COKE CO., LONDON:
The CORPORATIONS of MANCHESTER, BIRMINGHAM, CARLISLE, OLDHAM, STOCKTON, HALIFAX, &c.
And to the following Companies—viz.:
PHŒNIX, SOUTH METROPOLITAN, BRENTFORD, WINDSOR ROYAL, IPSWICH, WEST HAM, BILSTON, ARUNDEL, DUDLEY, ST. HELEN'S, MORECOMBE, THRAPSTONE, &c.,
And to the various WORKS of the
BRITISH GASLIGHT COMPY.

Every Valve warranted perfectly Gas-tight.

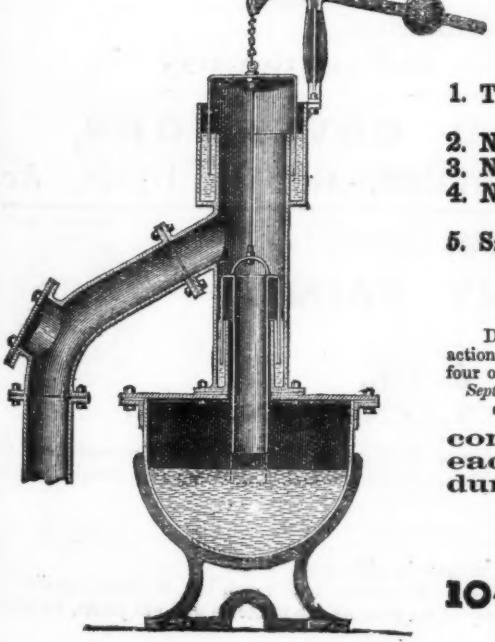
SOLE MAKERS, S. OWENS & CO.,
ENGINEERS,
WHITEFRIARS STREET, LONDON.
PRICES ON APPLICATION.

TO GAS AND RAILWAY COMPANIES, LOCAL BOARDS, ENGINEERS, CONTRACTORS, SHIPPERS, &c.



WILLIAM KEEN,
SOLE PROPRIETOR AND MAKER OF
KEEN'S PATENT DOUBLE-FRAME CLIP-LAMP,
AND MANUFACTURER OF
EVERY DESCRIPTION OF STREET-LAMPS.
FOR PARTICULARS, APPLY TO
W. KEEN, 23, ROBERTSON ST., & 5 & 6, PRIORY STREET, HASTINGS, SUSSEX.

SELF-ACTING REMOVABLE DIP-PIPE,
PATENTED BY
CHANDLER & STEVENSON.



ADVANTAGES.

1. There is no pressure on the Retorts.
2. No deposit of Carbon.
3. No scurfing is required.
4. Never a choked Ascension-Pipe.
5. Saves Fuel and Wear and Tear.
6. Gets 10 per cent. more Gas out of the Coal, and a higher Illuminating Power.
7. Is never out of order.
8. Requires no attention.
9. Is perfectly automatic in its action.

Testimonial from the Proprietor of the Apeldorn Gas-Works.

Dear Sir,—In reply to your inquiry, the Self-Acting Dip-Pipes, which have been in action at my works for two years, give entire satisfaction. I forward you order for four others.

Yours truly,
Sept. 9, 1877. R. Bakker.

These Dip-Pipes can now be supplied complete, except the flanched bend, for £4 each, which includes the charge for licence during the whole term of the patent.

APPLICATIONS TO BE MADE TO
Messrs. CHANDLER & SONS,
104, NEWINGTON CAUSEWAY, S.E.,
Who fix the Dip-Pipes, at a small Charge, when required.

Now Ready, price 28s., handsomely bound in Morocco, cloth sides, gilt edged and lettered,

THE FIRST VOLUME

OF

KING'S TREATISE

ON THE

SCIENCE AND PRACTICE OF THE MANUFACTURE & DISTRIBUTION

OF

COAL GAS.

EDITED BY THOS. NEWBIGGING, C.E., M.INST.C.E., AND W. T. FEWTRELL, F.C.S.

This Volume contains 460 pages of Letterpress, and is illustrated by 521 Woodcuts and 36 page and double-page Engravings printed on Plate paper, and a full-page

COLOURED ENGRAVING OF THE BECKTON GAS-WORKS,

Forming a Frontispiece to the Volume.

ORDERS RECEIVED BY THE PUBLISHER,

WILLIAM B. KING, 11, BOLT COURT, FLEET STREET, LONDON, E.C.

THE

STANDARD WASHER AND SCRUBBER.

[KIRKHAM, HULETT, AND CHANDLER'S PATENT.]

Some of the advantages claimed for this Apparatus are as follow:—

The Exposing of a large Amount of Effectually-wetted Surface (which is continually reproduced) to act upon the Gas.
Unerring Regularity in the Distribution of the Liquor.
Saving of Expense in Providing and Exchanging Scrubbing Material—none being required.
Economy of Space, thus enabling the Apparatus to be protected from the Weather.
Economy of First Cost and of Maintenance.
It works without Pressure.
It is particularly adapted for Gas-Works where Sulphate of Ammonia is manufactured.

Applications for Prices, &c., to be made to

Messrs. KIRKHAM & HERSEY, GAS ENGINEERS, 21, ABINGDON STREET, WESTMINSTER.

ALDER AND MACKAY,

GRANGE WORKS, EDINBURGH,

MANUFACTURERS OF

CONSUMERS IMPROVED GAS-METERS;

IMPROVED DRY GAS-METERS, in Cast-Iron and Tin Cases,

OF THE HIGHEST EXCELLENCE,

Warranted to measure correctly, and not to vary.

STATION METERS AND GOVERNORS,

EXPERIMENTAL METERS, PHOTOMETERS, GASHOLDERS, &c.

1862.

HALLETT'S

PATENT ANTIMONY PAINT.

MADE ONLY BY

GEORGE HALLETT & CO.,

296, ROTHERHITHE, LONDON, S.E.

CLASS II.

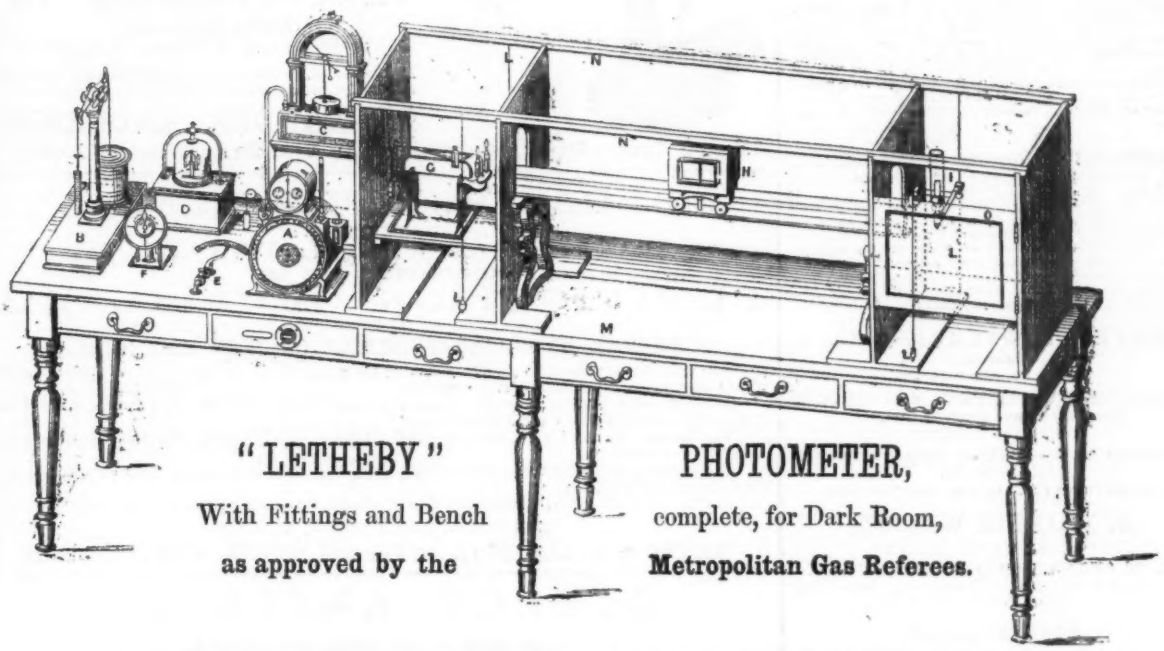
This Paint having been in general use over sixteen years (especially in some of the principal Gas-Works), and proved itself the best light-coloured Paint produced for resisting the influence of vitiated atmospheres, it is important that its qualities should be more widely known. Its advantages are that—

It does not require DRIERS like other Paints.
It does not poison the painter like white lead. No colic by its use.
It has greater durability in colour, as sulphurous gases do not blacken it as they do white lead.
It is of a light stone colour, and has a body equal to white lead, and as its specific gravity is so much less, it covers equally well one-third more surface, by which a great saving is effected; a similar economy arises from its use in steam and gas joints, for which purpose it is superior to white lead.

WILLIAM SUGG,

GAS ENGINEER,

VINCENT WORKS, WESTMINSTER, S.W.



"LETHEBY" PHOTOMETER,

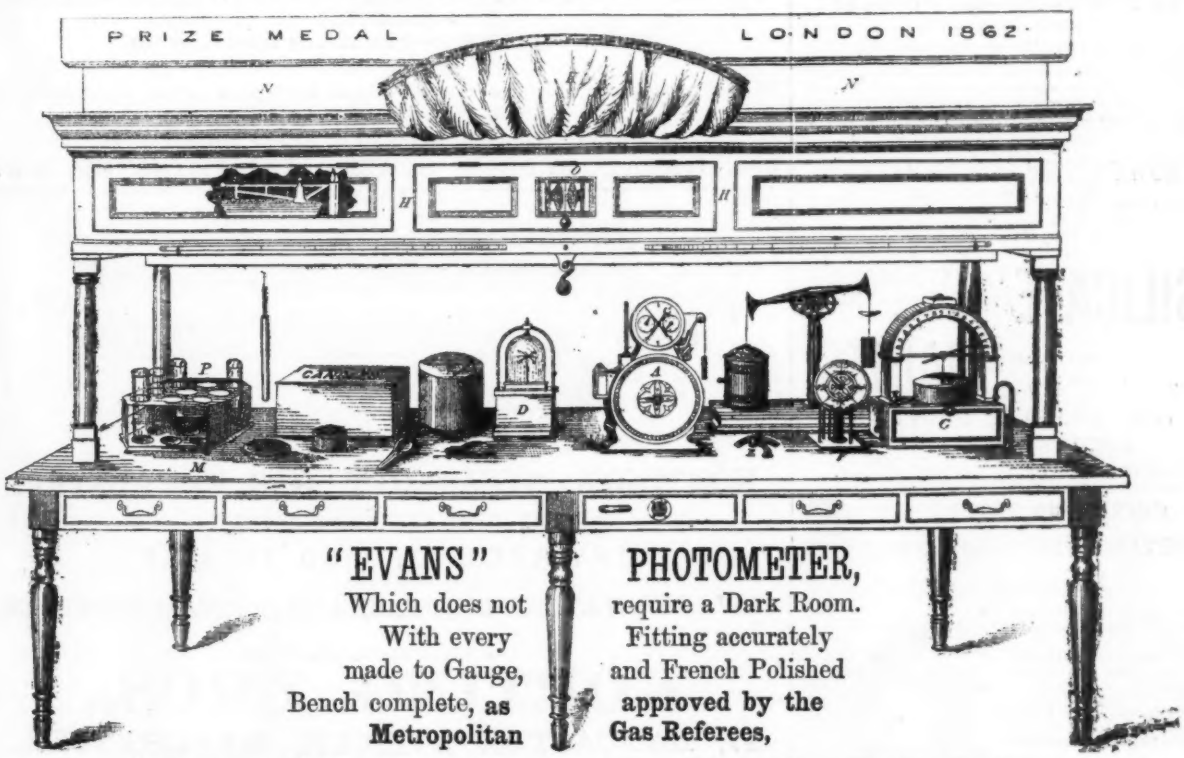
With Fittings and Bench complete, for Dark Room,

as approved by the Metropolitan Gas Referees.

IMPROVED LOWE'S JET PHOTOMETER.

WILLIAM SUGG'S PATENT ILLUMINATING POWER METER.

All Kinds of Gas-Testing Apparatus of the most approved forms.



"EVANS" PHOTOMETER,

Which does not require a Dark Room.

With every Fitting accurately made to Gauge, and French Polished Bench complete, as approved by the Metropolitan Gas Referees,

And as supplied and fixed by me at the Metropolitan Testing-Stations.

Price Lists and all Particulars on application.

NOTICE TO MANAGERS OF GAS COMPANIES.

THE LAW UNION FIRE AND LIFE INSURANCE COMPANY, of No. 126, Chancery Lane, London, grants Policies of Insurance on Gas-Works, and Buildings connected therewith, which cover risk of explosion and spontaneous ignition of Coal, on very advantageous terms. Full particulars will be sent post free on application to FRANK M'GEDY, Secretary.

126, Chancery Lane, London.

CATHELS'S Patent District Dry Gas-GOVERNOR is the only perfect self-acting contrivance for Regulating the Pressures in the higher levels of a district.

For prices, &c., apply to the Manufacturers, Messrs. GUEST AND CHRIMES, ROTHERHAM.

CATHELS & TERRACE'S Patent Four-WAY DISC GAS-VALVE is the simplest and best Valve for Purifiers, and as a By-pass for other apparatus in Gas-Works. It is always gas-tight, and has no springs, ground faces, or other delicate parts. By its use the flow of the gas cannot be accidentally stopped, and it never sticks.

For prices, &c., apply to the Manufacturers, Messrs. GUEST AND CHRIMES, Foundry and Brass Works, ROTHERHAM.

CATHELS'S Improved Retort-Settings. Guaranteed to heat and wear well, with great economy of Fuel.

Coloured lithograph copies of Working Drawings of Beds of One to Seven Retorts (so clearly arranged and fully shown as to be easily understood by any retort setter or bricklayer) having been made of these valuable settings, they can now be supplied with detailed Specification immediately on receipt of orders.

Apply to Mr. THOS. NEWBIGGING, Consulting Gas Engineer, 5, Norfolk Street, MANCHESTER.

HOPKINS, GILKES, & CO.,
LIMITED,
MIDDLESBOROUGH,
SUPPLY GAS & WATER PIPES of EVERY SIZE.
Plain, Turned and Bored, and Coated.
CAST-IRON RETORTS.
Castings for Gas-Works of every description.
EXHAUSTERS.
LONDON OFFICE: 25, LAURENCE POUNTNEY LANE.

A. FAIRLIE WILSON,
CONSULTING GAS ENGINEER,
34, ST. GEORGE'S ROAD, SOUTHWARK, S.E.
Reports and Valuations in the Management, Construction, and Structural Value of Gas-Works.

JOHN SPENCER,
VULCAN WORKS, WEST BROMWICH, & 97, CANNON ST., LONDON,
Manufacturer of Every Description of
TUBES & FITTINGS,
Plant, Tools, Stores, and all requisites for Gas and Water Works: Gasholders, Purifiers, Scrubbers, Roofing, Sashes, Retort Fittings, Grids, Socket-Pipes, Lamp-Posts, Wheelbarrows; Brasswork, Chandeliers, and Gas-Fitters Tools; Liquor-Pumps, Valves; Clay Retorts and Fire Goods, &c.

THE BROUGHTON COAL COMPANY,
COLLIERIES, NEAR WREXHAM,
Are prepared to Supply their excellent GAS COAL on very favourable terms.

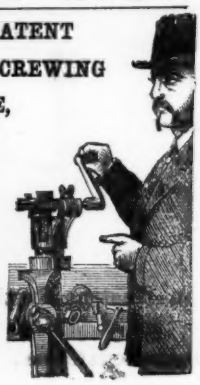
This Coal yields more than 10,000 cubic feet per Ton of gas of good quality, *in practical working on the large scale.*

A large purchaser reports the coke to be clear, of a quality rarely equalled in the retort-furnace, and much liked by the stokers.

YEO'S PATENT ENGINE PACKING,
Price 1s. 8d. per lb., any size.
Tarred & White Spun Yarn for Pipe Joints, at various prices.
Samples and testimonials free per post.
E. YEO, NEWTON ABBOT.

SILICATE THE BEST & CHEAPEST
For every purpose to which Paint is applied.
MANUFACTURED IN ALL COLOURS BY **PAINTS.**
THE SILICATE PAINT CO.,
LONDON— 107, CANNON STREET, E.C.
LIVERPOOL— SEEL STREET.

GRIRDROD'S PATENT
PORTABLE PIPE SCREWING MACHINE,



For 1 in., 1¼ in., 1½ in., and 2 in. Gas Threads, complete £7 10s.

In use at the chief gas-works, and giving great satisfaction.

For other useful goods, see Bailey's "Illustrated Inventions," post free 3s. 6d.; gratis to ledger customers.

W. H. BAILEY & CO.,
Brassfounders, Gauge Injector and Tool Makers,
ALBION WORKS, SALFORD, LANCASHIRE.

GREAT SAVING OF LABOUR.
ENOCH'S PATENT
PORTABLE DRILLING-MACHINE,
Now in use by all the Principal Gas and Water Companies in the United Kingdom.

E Size, for Services in Pipes, 2 to 3 in. bore	£3 10 0
F Size, for Services in Pipes, 2 to 4 in. bore	4 0 0
G Size, for Services in Pipes, 2 to 6 in. bore, with Telescope Cramp.	4 10 0

Drills, 1s. 6d. each.
Machines sent on approval, if desired.
Prices for other Sizes and Modifications, with full Particulars and Testimonials, on application to
ALEXANDER ANDERSON,
Office: 9, London Street, E.C. Warehouse: Vine Street, Minories, London, E.

GAS PURIFICATION.
BAILES & HALLSWORTH,
CONTRACTORS FOR THE
PURIFICATION OF COAL GAS
BY THEIR
PATENT HYDRATED PEROXIDE OF IRON MATERIAL.

The Material is adapted specially for taking up sulphuretted hydrogen, and will simultaneously absorb any ammonia that may pass the scrubbers.

The spent oxide resulting from our Material is more valuable than that from natural oxide of iron, and manufacturing chemists buy it in preference.

The Material has now been in use during the past three years in most of the principal Gas-Works in Yorkshire and elsewhere.

It contains considerably less moisture than natural oxide of iron, and is much cheaper and more efficient as a purifying agent.

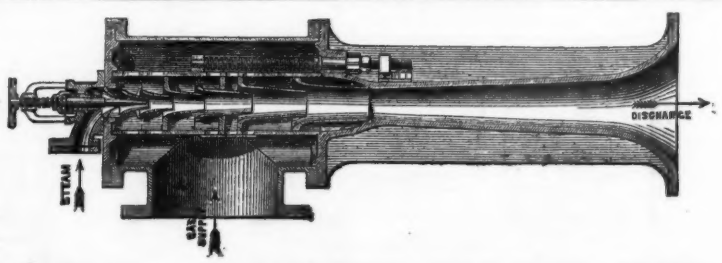
B. & H. are purchasers of Spent Oxide, or will take Spent in exchange for New Material.

FOR SAMPLES AND TERMS, ADDRESS—
BAILES & HALLSWORTH, COPPERAS WORKS, ARMLEY. LEEDS.

GEORGE ANDERSON,
GAS AND CONSULTING ENGINEER,
35A, GREAT GEORGE STREET,
WESTMINSTER, S.W.,
PATENTEE and MANUFACTURER of the following Invention
RETORT SETTINGS—giving great Economy of Fuel.
STEAM-ENGINES and EXHAUSTERS, FOUR-WAY VALVES, WASHERS, SCRUBBERS.
FUEL-MACHINE, for Compressing Breeze and Tar.

N.B.—Pamphlet, with Eighteen Illustrations and Letterpress on the Construction of Gas-Works, post free, 2s. 6d.

PRICES AND ALL PARTICULARS TO BE HAD OF THE PATENTEE,
35a, GREAT GEORGE STREET, WESTMINSTER, S.W.



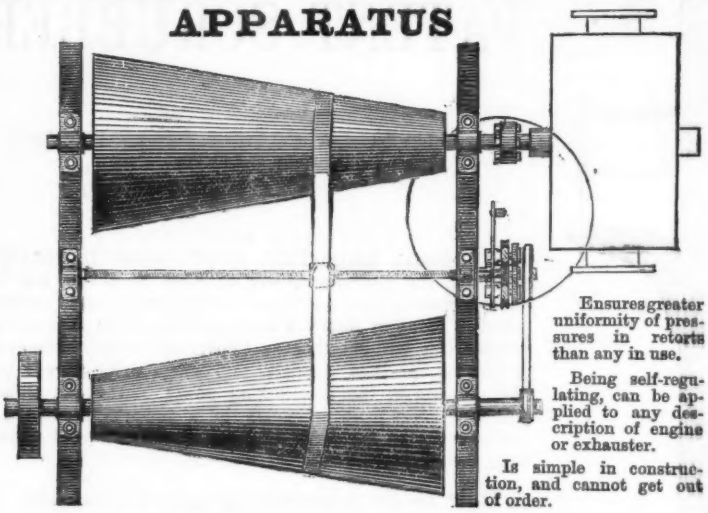
KÖRTING'S STEAM-JET GAS-EXHAUSTER.
IMPROVED CLELAND'S PATENT.
UPWARDS OF 250 IN USE.
CLELAND'S PATENT CONDENSER AND STEAM SCRUBBER.
FOR PARTICULARS, APPLY TO
KÖRTING BROS.,
17, LANCASTER AVENUE, MANCHESTER,
OR TO
GERALD J. TUPP, 8, John Street, Adelphi, W.C., LONDON,
SOLE AGENT FOR ENGLAND AND WALES.

COMMERCIAL GLASS WORKS, 27, WELLCLOSE SQUARE, LONDON, E.

CHEAPEST HOUSE IN THE TRADE FOR GAS GLASSES OF EVERY DESCRIPTION.

Write for Lists, free on application to any part of the World.

FISON'S PATENT SELF-REGULATING GAS-EXHAUSTING APPARATUS



Ensures greater uniformity of pressures in retorts than any in use.

Being self-regulating, can be applied to any description of engine or exhauster.

Is simple in construction, and cannot get out of order.

JASPER & WM. SNOWDON, Manufacturers,

OLD BANK CHAMBERS, PARK ROW, LEEDS.

Full Particulars, Testimonials, Descriptive Circulars, Estimates, &c., on application.

J. & J. BRADDOCK,

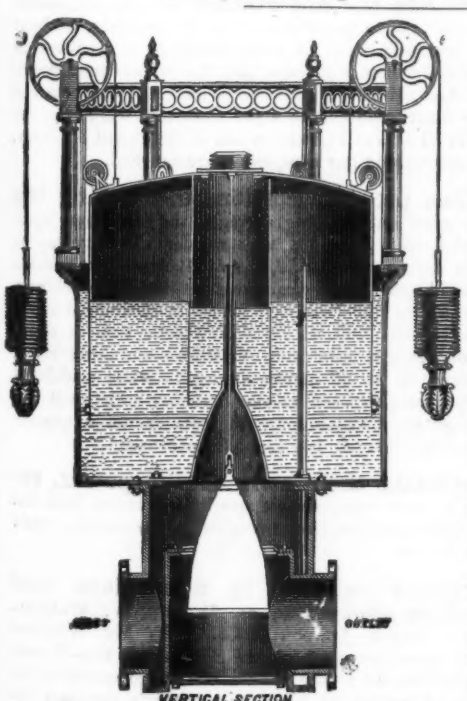
GLOBE METER-WORKS,

OLDHAM,

Beg to submit to Gas Engineers their

PATENT COMPENSATING GAS GOVERNOR,

Which is designed to give an uniform pressure at the Outlet to the Main at all draughts up to the full quantities which the Governors are made to control, such outlet pressure being less than the initial pressure.



The uniformity of pressure is obtained by introducing a compensating chamber into the Bell or Holder of the Governor, which compensator is of the same area as the valve, both of which are operated on by the initial pressure, thereby placing the valve in equilibrium, no matter what the initial pressure may be. The action on the Bell is by the Gas passing along a pipe from the outlet, and the pressure is regulated by weights in connexion with the Bell as required.

From the sectional elevation attached hereto, it will be seen that only the Gas required to operate the Bell comes in contact with the water of the tank, which water will remain comparatively sweet and free from odour. That in case of accident to the Bell, no more Gas can escape than would pass up the pipe covering the valve-rod and Bell supply-pipe.

These Governors have been made and sent out of various sizes for from 2 to 24-inch Mains, and give most satisfactory results.

They can be made with Float in the Bell, or counterpoise as per section.

ALFRED LASS,

SPECIAL ACCOUNTANT FOR GAS COMPANIES,

30, GRACECHURCH STREET, LONDON.

Accounts analyzed and Statistics Prepared for Parliamentary Proceedings, Arbitrations, &c.

The Forms of Account, which have been specially designed by A. L. to meet the requirements of the Gas-Works Clauses Amendment Act, 1871, are now in use by many Gas Companies, and have been universally approved.

The above forms are registered.

Water Companies Accounts also prepared and adjusted.

CONSULTATIONS.

T. NEWBIGGING,

CONSULTING GAS ENGINEER,

5, NORFOLK STREET, MANCHESTER.

MR. EDWARD SANDELL,

Associate of the Society of Accountants in England, Publisher of the "Gas Companies Expenditure Journal,"

Begs to announce his REMOVAL from Skinner's Place, Size Lane, to

No. 2, ST. GEORGE STREET, WESTMINSTER.

Mr. ROBERT DEMPSTER, Sen.,

CONSULTING GAS ENGINEER,

Of Messrs. Robert Dempster and Sons, Rose Mount Gas Engineering Works,

ELLAND, near HALIFAX,

May be consulted on all matters connected with Valuations, Arbitrations, and Parliamentary Applications connected with Gas-Works. Our R. D., Sen., having been engaged on extensive Arbitration Cases, which, combined with his experience in Construction and Contracting, his knowledge of Engineering and Valuations, is both extensive and reliable.

JOHN ROMANS, C.E., F.G.S.E.,

CONSULTING GAS ENGINEER AND

CANNEL COAL FACTOR,

30, St. Andrew Square, EDINBURGH.

Plans and Estimates furnished; Gas-Works, Apparatus, Pipes, Machinery, Fire Goods, &c., supplied, or Attested and Shipped for Exportation.

GAS-WORKS TAKEN ON LEASE.

Mr. ROMANS has for upwards of 30 years been practically engaged in the Manufacture of Gas, and has, by extensive experiments, ascertained that by JUDICIOUS INTERMIXTURE of the lighter with the heavier gases, much of the rich Hydrocarbons CAN BE SAVED, which otherwise ARE LOST, during the process of manufacture. He is therefore enabled to give advice to those who favour him with their orders for Cannel, as to the class which will secure for their standard of illuminating power the HIGHEST ADVANTAGEOUS RESULTS.

ANALYSIS AND PRICES FORWARDED ON APPLICATION.

THOMAS CARR & SON,

MANUFACTURERS OF

FIRE-BRICKS, LUMPS, TILES, RETORTS, &c.,

SCOTSWOOD FIRE-BRICK WORKS, SCOTSWOOD-ON-TYNE.

Also Makers of all kinds of Common Building Bricks, and of Pressed White and Red Bricks for Facing.

BIRTLEY IRON WORKS,

CHESTER-LE-STREET, DURHAM.

Manufactory for every description of Casting and Machinery for Gas-Works and Water-Works.

Warehouse in London for Cast-Iron Pipes and Connexions of all sizes and in any quantity, Scott's Wharf, Bankside, Southwark.

Agent in London, Mr. J. MAINWARING, 101 Cannon Street, E.C.

BOUCK & CO., LIMITED,

TAR DISTILLERS & MANUFACTURING CHEMISTS,

MILES PLATTING, MANCHESTER.

BRANCH WORKS, BLACKBURN.

BUYERS OF COAL TAR,

And Crude Products therefrom,

AMMONIACAL LIQUOR, &c.

TO GAS-METER MANUFACTURERS.

G. A. BAILEY AND CO.,

MANUFACTURERS OF EVERY DESCRIPTION OF

Station, Hourly Rate, Experimental, and other Indexes, Wheel and Worm Cutters,

86, CRAMPTON STREET, NEWINGTON BUTTS, LONDON, S.E.

N.B.—Materials found or otherwise.

TO INVENTORS AND PATENTEES.

MR. W. H. BENNETT, having had considerable experience in matters connected with Gas, Water, and Sanitary Improvement, begs to say that he continues to assist Inventors in the perfection of their designs, and to obtain for them PROVISIONAL PROTECTION, whereby their invention may be secured for Six Months; or LETTERS PATENT, which are granted for Fourteen Years.

Patents completed, or proceeded with at any stage, thereby rendering it unnecessary for persons resident in the country to visit London.

Patents procured for Foreign Countries.

Information as to cost, &c., supplied gratuitously upon application to the Advertiser, 22, Great George Street, WESTMINSTER.

C. & W. WALKER,
8, Finsbury Circus,
London, E.C.

MANN & WALKERS' PATENT SCRUBBER.

By Letters Patent in Great Britain, Europe, and the United States of America.

By some important improvements recently patented, the purifying power of these Scrubbers has been much increased, and a stronger ammoniacal solution obtained, which is found to absorb a large portion of the carbonic acid contained in gas, effecting an important saving in money and labour in the lime purifiers, and where oxide only is used, the increase in the illuminating power of the gas obtained by these Scrubbers is shown in a remarkable degree, in consequence of the large quantity of carbonic acid removed from the gas.

It is to be particularly noted that the im- portant results of these Scrubbers do not depend upon the machinery alone. The entire internal construction of the Scrubber bears an almost equally important part. For this reason, where it is desirable to convert existing Scrubbers, whose dimensions happen to be suitable, the work commences by ripping out the whole of the interior of the shell, and beginning the internal construction *de novo* from bottom to top.

Fifty million cubic feet of gas per 24 hours are purified from ammonia by these Patent Scrubbers in a winter's day in the gas-works of London, where the purity of gas supply is the highest in the world, under the chemical restrictions of the Board of Trade.

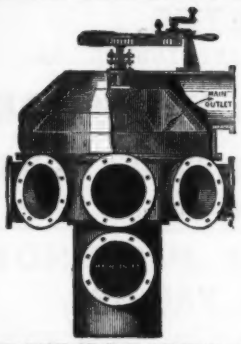
Generally, wherever a high standard of purification is maintained in the chief cities and towns of the British Provinces and of Europe, these Scrubbers have become established.

By their use the department of purification from ammonia upon a gas-works is made complete, without the aid of prepared oxide of iron, chemicals in purifiers, or any other supplementary process, and the whole ammoniacal residual product contained in the coal is absorbed and obtained in the form most profitable to a gas company, while the requirements of all Acts of Parliament and of the Board of Trade, relating to incorporate gas companies, are satisfied.

Foul Gas, properly condensed, entering the inlet is, by once only passing through the Scrubber, completely purified from ammonia with regular certainty day by day, without any further trouble, or any other process, effected by a very small quantity of clear water let into the machinery room at the top of the Scrubber, which is discharged at the liquor outlet at the bottom, from Newcastle coal at about 18 to 20 ounces strength, from Yorkshire and other coals, generally from 25 to 30 ounces strength; while acidulated litmus or turmeric exposed at the Scrubber outlet will not show the slightest discoloration, and there is not a quarter of a grain of ammonia per 100 feet left unabsorbed.

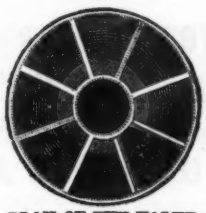
They contain their own engine power, requiring only a small inappreciable quantity of steam from the gas-works boiler, and are then complete in themselves, ready for service.

Applications relating to dimensions and prices should be addressed to us, C. and W. Walker, 8, Finsbury Circus, London, E.C., or to Mr. William Mann, late Superintendent of the Chartered Gas-Works, Blackfriars, London; they should state approximately the largest make of gas in 24 hours on a winter's day, and the smallest make on a summer's day, to be purified.

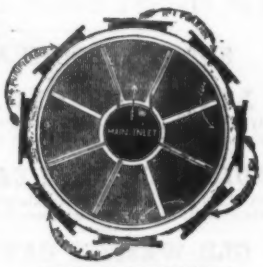


ELEVATION OF THE CENTRE-VALVE.

C. & W. WALKERS'
PATENT CENTRE-VALVES.



PLAN OF THE VALVE.



PLAN OF THE BODY.

These PATENT CENTRE-VALVES are the most perfect and certain means for working Purifiers on the system of three in action, and one out of action. The Valve itself is protected from all injury inside the safety cover. The working of the Valve is so easy, and so governed by the stop-catch movement, that the Purifiers can be instantaneously changed in the dark as well as in daylight. They are scraped perfectly true, metal to metal, the facings heretofore exposed are always covered, and there is nothing more reliable, certain, and durable in a gas-works. By their use the floor of the Purifying-house is clear and level; the Valve and all connexions being beneath the floor, out of the way of working. A considerable improvement and saving is effected in the cost of the connecting-pipes.

MIDLAND IRON-WORKS, DONNINGTON, near NEWPORT, SHROPSHIRE; 8, FINSBURY CIRCUS, LONDON.

W. C. HOLMES & CO.,

WHITESTONE IRON-WORKS, HUDDERSFIELD,

MANUFACTURERS OF

RETORTS, ANNULAR AND PIPE CONDENSERS,

WROUGHT AND CAST IRON SCRUBBERS, PURIFIERS, GASHOLDERS,

GOVERNORS, AND ALL THE NECESSARY FITTINGS FOR COMPLETING THE ERECTION OF GAS-WORKS.

STATION & CONSUMERS WET OR DRY METERS, STREET & SERVICE MAINS, LAMP COLUMNS & BRACKETS, & WROUGHT-IRON TUBES AND FITTINGS; WROUGHT-IRON ROOFS FOR ANY SIZE OF BUILDINGS.

Sole Makers of B. W. Thurston's Combined Condensing, Scrubbing, and Washing Apparatus,

AND PATENTEES OF THE IMPROVED COMBINED CONDENSING AND PURIFYING APPARATUS SO EMINENTLY ADAPTED FOR EXPORTATION.

REFERENCES TO UPWARDS OF 300 GAS-WORKS.

FLETCHER AND MURPHY,

GARRATT STREET WORKS, OLDHAM ROAD, MANCHESTER;

Manufacturers of

IMPROVED CONSUMERS WET GAS-METERS

IN CAST-IRON CASES,

THE UNVARYING WATER-LINE GAS-METER,

AND

IMPROVED DRY GAS-METERS;

STATION-METERS OF ALL SIZES, with PLANED JOINTS;

GOVERNORS, PRESSURE AND EXHAUST REGISTERS, TEST HOLDERS.

And all kinds of Experimental Gas Apparatus.

MESSRS. NEWTON, CHAMBERS, & CO.,

THORNCLIFFE IRON-WORKS, NEAR SHEFFIELD,

MANUFACTURERS OF

IMPROVED CENTRE-VALVES,

PURIFIERS, CONDENSERS, SCRUBBERS, GASHOLDERS, ROOFS,

And every description of Gas Machinery.

TENDERS GIVEN FOR WORK FIXED COMPLETE IN ANY PART OF THE KINGDOM.

ROBERT MARSHALL,
CANNEL COAL MERCHANT,
198, ST. VINCENT STREET, GLASGOW.

SHOTT'S BOGHEAD.

LOTHIAN'S CANNEL
Yields 12,500 cubic feet of 24-candle gas per ton, and 9 cwts. of excellent coke, containing only 4 per cent. of ash.

MUIRKIRK, No. 1, CANNEL
Yields 12,180 cubic feet of 32·5-candle gas per ton, and 10 cwts. of excellent coke, containing only 5 per cent. of ash.

OLD WEMYSS CANNEL
Yields 13,320 cubic feet of 32·5-candle gas per ton.
Prices and full Analyses on application.

GAS COAL.
POPE & PEARSON, LIMITED, have now the authority of several of the most eminent Gas Engineers of London in stating that their Coal yields *in practical working over* 10,000 *cubic feet of gas, with an illuminating power of* 16 *candles;* or by the standard burners now used by the London Gas Companies, an illuminating power equal to 17½ candles.
One ton yields 12½ cwt. of good coke. This Coal can be shipped from Hull, Goole, Liverpool, Morecambe, and Barrow.
For further particulars, apply to POPE AND PEARSON, LIMITED, West Riding and Silkstone Collieries, near LEEDS.

SCOTCH CANNEL COALS.
The Subscriber is prepared to contract for the supply of all the principal SCOTCH CANNEL COALS. Prices and Analyses of the various Coals will be forwarded on application.
JAMES M'KELVIE,
CANNEL COAL MERCHANT,
HAYMARKET, EDINBURGH.
Established 1840.

HEBBURN MAIN GAS COALS.
T. Stone, Esq., of Weymouth, writes on Nov. 17, 1876: "I have used about 12,000 tons of this Coal, with, I think, the best possible results, although not always under the most favourable circumstances. My Coal account made up to Midsummer last showed a makeage of 10,594 cubic feet per ton of 14¼-candle gas, and not a hundredweight of Cannel used. This statement would, I know, be incredible to many men, and may provoke the remark, 'How much of it is paid for?' For the gratification of such, I have to say that, of the above quantity, 9866 cubic feet per ton of Coal carbonised were brought to charge and duly paid for, with the exception of about 6s. per cent. for bad debts. The coke is of excellent quality. The above facts I hold to be a greater recommendation to your Coal than any words of mine could be."
PRICES ON APPLICATION, EITHER F.O.B. OR BY RAIL IN TRUCK LOADS.
THE TYNE COAL COMPANY, LIMITED, OWNERS.
W. RICHARDSON, Fitter,
29, QUAYSIDE, NEWCASTLE-ON-TYNE.

FERRAND DAVIES,
148 GRESHAM HOUSE, OLD BROAD STREET, LONDON, E.C.,
AGENT FOR
THOMAS BARR'S LESMAHAGOW MAIN CANNEL,
AND
NEWTON, CHAMBERS, & CO.'S SILKSTONE GAS COALS.
Analyses and Quotations on application.

WILSON CARTER AND PEARSON,
GAS COAL AND CANNEL FACTORS,
Supply to any Railway Station or for Export all kinds of Fuel for Gas purposes.
Address—CHIEF OFFICES:
TEMPLE BUILDINGS, 50, NEW STREET, BIRMINGHAM.

CANNEL COAL.
ELLIS LEVER & CO., Central Coal Offices, 46, Cannon Street, London, E.C., and 6, Piccadilly, Manchester, are prepared to contract for the supply of THE BEST CLASSES of CANNEL and GAS COAL, for long or short periods. Analysis and prices on application.

ELLIS LEVER & CO.,
CANNEL AND GAS COAL CONTRACTORS,
Shippers of Steam and House Coal
AT ALL
ENGLISH, SCOTCH, AND WELSH PORTS.
46, CANNON STREET, LONDON,
AND
6, PICCADILLY, MANCHESTER.

ECONOMY IN THE PRODUCTION OF GAS.
PLUTONIC CEMENT,
For Jointing and Repairing Retorts and Ovens *in* action and *out* of action.
A Pamphlet on the advantages of the above, with modes of Application, References, Prices, &c., free by post, from the Sole Manufacturer,
WILLIAM RICHARDSON, GAS AND HYDRAULIC ENGINEER,
CHARLES HENRY STREET AND BISSELL STREET, BIRMINGHAM.

THE WIGAN COAL & IRON COMPANY,
LIMITED,
DISTRICT OFFICE: 97, NEW STREET, BIRMINGHAM; AGENT: W. M'GOWAN;
Supply the Best Wigan Arley Mine Gas Coal, Gas Nuts, Gas Cannel, &c.
N.B.—The Wigan Coal and Iron Company, Limited, are exclusive owners of the well-known HAIGH HALL AND KIRKLESS HALL GAS COAL COLLIERIES.

ALBERT GAS COAL.
THE DERBYSHIRE
SILKSTONE COAL COMPANY,
LIMITED,
CAN OFFER A
GAS COAL
Of superior quality, delivered in trucks at any Railway Station in England, or shipped on board at Hull, Grimsby Docks, or Barrow-in-Furness.

Purified gas per ton of coal in cubic feet (average)	10,775
Illuminating power in candles	14·71
Weight of coke in lbs. per ton of coal	1,502

ANALYSIS AND PRICES ON APPLICATION TO
Mr. EDMUND TAYLOR, Secretary,
ALBERT COLLIERY, NEWBOLD, NEAR CHESTERFIELD.

THE SILKSTONE & DODWORTH COAL & IRON COMPANY, LIMITED,

DODWORTH, BARNSLEY.

BENJAMIN WHITWORTH, Esq., M.P. . . . . Chairman.
Mr. RICHARD HARTLEY . . . . . Managing Director.

REAL OLD SILKSTONE GAS COAL.

JAMES PATERSON Esq., Gas Engineer, of the Warrington Gas Company, reported, Aug. 10, 1875:—

"This Coal possesses remarkable qualities as a gas and coking coal, and appears SECOND TO NONE IN THE KINGDOM. It contains the large quantity of 699 lbs. of illuminating matter, and 1498 lbs. of coke to the ton, and produces **12,240** cubic feet of 16·66 candle gas."

The above Company are raising nearly a thousand tons of the Real Old Silkstone Gas Coal per working day.

PRICES QUOTED TO ANY RAILWAY STATION, OR F.O.B. HULL, GRIMSBY, GOOLE, KEADBY, LIVERPOOL, AND FLEETWOOD.

HYDRATED PURIFYING MATERIAL.

Samples on application.

MESSRS. SPENCE BROS., LIMITED,

Will be glad to supply the above on the most favourable terms,

And to treat, by Purchase or Exchange, for Spent Oxide.

PRICES ON APPLICATION.

ALSO PATENT DRY COPPERAS FOR EXTRACTING AMMONIA.

VICTORIA CHEMICAL WORKS, BRADFORD, NEAR MANCHESTER.

Established

1795.

JOSEPH CLIFF & SONS,

THE ORIGINAL

WORTLEY FIRE-BRICK WORKS,

NEAR LEEDS,

London Wharf: No. 4, inside Great Northern Goods Station, King's Cross, N.;

LIVERPOOL: Back Leeds Street.

SPECIAL NOTICE.—Our Patent Machine-made Retorts have now been in *actual work* nearly 1000 days, and are yet in good order. References on application.

July 2, 1877.

NEWTON, CHAMBERS, & CO.,

THORNCLIFFE IRON-WORKS AND COLLIERIES,

NEAR SHEFFIELD.

CELEBRATED SILKSTONE GAS COALS.

The various descriptions of Gas Coal produced from the above Collieries possess an unequalled reputation, combining in a large degree the constituents essential for the production of the best quality of Coke and Gas of a high illuminating power.

A recent extensive development of the Collieries enables us to offer increased supplies.

JAS. PATERSON, Esq., of Warrington, after testing various qualities of our Coal, has sent the following testimony of their merits:—

"Warrington Gaslight and Coke Company,
Offices, Mersey Street, Warrington, April 23, 1877.

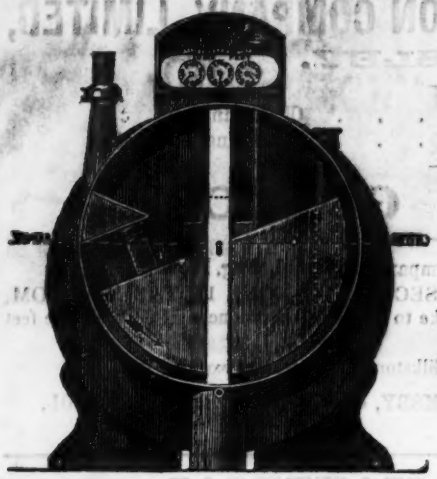
"MESSRS. NEWTON, CHAMBERS, AND CO.,

"GENTLEMEN,—After carefully testing the various samples of Gas Coals sent from your Collieries for analysis, I have pleasure in reporting them as belonging to the highest class of Gas and Coking Coals.

"The average of Nine samples gives a yield of **12,500** cubic feet of **15½**-Candle Gas, being equivalent to **664** lbs. of sperm per ton, and **1420** lbs. of fixed carbon of a very superior quality. All the samples bear a close relation to each other in value.

"Yours truly, "JAMES PATERSON."

Full particulars will be sent on application to us—address as above.



THE

UNVARYING WATER-LINE GAS-METER,

(SANDERS AND DONOVAN'S PATENT.)

"Unquestionably the best Water Gas-Meter now in use."—Thos. G. Barlow, C.E.

Over 120,000 in action.

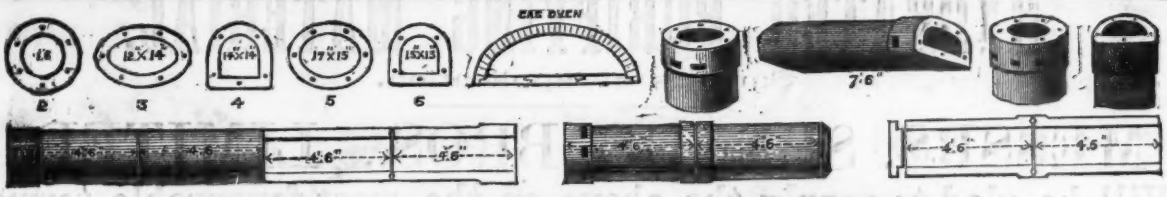
MANUFACTURERS:

THE GAS-METER COMPANY, LIMITED,

KINGSLAND ROAD, LONDON;

WITH

Branch Manufactories at DUBLIN and OLDHAM.



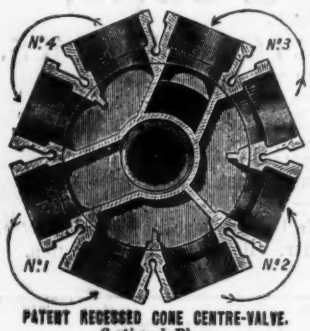
HARRIS & PEARSON, STOURBRIDGE,

Proprietors of Best Clay Mines. Largest makers in the World of Gas-Retorts, Lumps, Tiles, Fire-Bricks, and Fire-Clay Goods of all kinds. Large Stock of Retorts always on hand. Orders for any Size executed on receipt.

CAST-IRON GAS AND WATER PIPES,

WROUGHT IRON AND LEAD TUBING, GLAZED DRAIN-PIPES,

STAFFORDSHIRE BLUE BRICKS.



PATENT RECESSED CONE CENTRE-VALVE.
Sectional Plan.

R. LAIDLAW AND SON,

EDINBURGH AND GLASGOW,

SOLE MAKERS OF

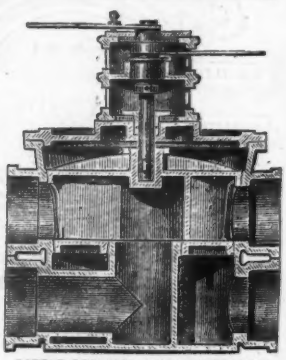
PATENT

RECESSED CONE CENTRE-VALVES,

Constructed on the principle of the ordinary Plug-Cock.

THROUGH-WAY & FOUR-WAY COCKS

Of all descriptions.



PATENT RECESSED CONE CENTRE-VALVE.
Sectional Elevation.

LONDON OFFICE: 106, CANNON STREET.

D. HULETT & CO.

Invite the attention of Gas Companies, Corporations, and others to their

PATENT STREET LAMPS,

Which are so constructed that neither putty nor other materials are required to secure the glass. No hacking out of old putty, which frequently destroys the frames. A new pane of glass can be inserted in two or three minutes by any inexperienced person, the glass being secured by a hinged flap and turn button.

PRICE 10s. each, net. Special quotations for large quantities.
Also made EXTRA STOUT recommended for its durability, PRICE 11s. 6d. each.

D. HULETT'S IMPROVED SERVICE CLEANSER,

By the use of which stoppages in service and other pipes are freed from naphthaline and other obstructions in a few minutes. PRICE 73s. net.

HULETT'S PATENT MERCURIAL REGULATOR,

For inserting in mains, to prevent the excess of pressure in high ground, or other elevated positions.

PATENTEES OF IMPROVED WET AND DRY GAS-METERS.

Makers of all kinds of Pressure-Gauges, Gaseliers, and every kind of Gas-Fittings for the Trade.

GAS HEATING AND COOKING STOVES.

55 and 56, HIGH HOLBORN, LONDON.

London: Printed by William Boughton King (at the office of Clayton and Co. 17, Bouverie Street, Fleet Street); and published by him at No. 11, Bolt Court, Fleet Street, in the City of London.—Tuesday, July 2, 1878.